Agilent Technologies

Vacuum Products Division

CE

VS Series Helium Mass Spectrometer Leak Detector

Models: PR02, MR15, MD30, BR15, BD30 and PD03

FIELD SERVICE COMPONENT REPLACEMENT MANUAL

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VS Series Helium Mass Spectrometer Leak Detector

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VS Series Helium Mass Spectrometer Leak Detectors:
Models VS PR02x, VS MR15x, VS MD30x, VS BR15x, VS BD30x and PD03
(With Optional Wireless Remote Control and Discrete I/O)

to which this declaration relates is in conformity with the following standards:

Safety:

EN 61010-1, Second Edition, 2001 - *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use-Part 1: General Requirements*

per the provisions of the **Low Voltage Directive 73/23/EEC** of 19 February 1973 as Amended by 93/68/EEC, Article 13, of 22 July 1993.

CAN/CSA-C22.2 No. 61010-1-04 - *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use-Part 1: General Requirements* (Adopted IEC 61010-1:2001, MOD)

UL 61010-1, Second Edition, 2004 - *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use-Part 1: General Requirements*

EMC Emission and Immunity:

EN 55011:1998/A1:1999/A2:2002 Group 1 Class A: *ISM radio-frequency equipment - Radio disturbance characteristics - Limits and methods of measurement (EU)*

EN 61326:1997/A1:*1998 /A2:2001 Electrical equipment for measurement, control and laboratory use - EMC requirements (EU)*

per the provisions of the **Electromagnetic Compatibility Directive 89/336/EEC** of 3 May 1989 as Amended by 92/31/EEC of 28 April 1992 and 93/68/EEC, Article 5 of 22 July 1993

AS/NZS CISPR 11:2004 Class A: *ISM radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement (Australia)*

FCC: Code of Federal Regulations, 47CFR:2004, Part 15C, Section 15.24, *Class A: Telecommunication, Radio Frequency Devices, Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz (USA)*

CAN/IC: Radio Standard Specification RSS-210, Issue 5, *for Low Power License-Exempt Radio communication Devices of Industry Canada,* November 2001 (Canada)

EMC and Radio Spectrum Matters:

EN 300 328-1 V1.3.1 (2001-12) *Electromagnetic compatibility and Radio spectrum Matters (ERM): Wiband Transmission systems; Data transmitting equipment operating in the 2.4 GHz ISM band and using spread spectrum modulation techniques; Part 1: Technical characteristics and test conditions (EU)*

EN 300 328-2 V1.2.1 (2001-12) *Electromagnetic compatibility and Radio spectrum Matters (ERM): Wiband Transmission systems; Data transmitting equipment operating in the 2.4 GHz ISM band and using spread spectrum modulation techniques; Part 2: Harmonized EN covering essential requirements under article 3.2 of R&TTE Directive (EU)*

EN 301 489-1 V1.3.1 (2001-09) *Electromagnetic compatibility and Radio spectrum Matters (ERM): Electromagnetic Compatibility (EMC) standard for radio equipment and services: Part 1: Common Technical requirements (EU)*

EN 301 489-17 V1.1.1 (2001-09) *Electromagnetic compatibility and Radio spectrum Matters (ERM): Electromagnetic Compatibility (EMC) standard for radio equipment and services: Part 17: Specific conditions for Wideband data and HIPERLAN equipment (EU)*

per the provisions of the **Radio and Telecommunications Terminal Equipment (R&TTE) Directive**, 1999/5/EC of 9 March 1999

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Preface

This manual contains information for field replacement of components of the VS Series Mass Spectrometer Helium Leak Detector. It is organized so that similar items or procedures are included in a section. The manual moves from a brief overview of the leak detector to specific replacement procedures to calibration and tuning procedures that must be run after the replacement of certain components. Photographs are liberally used to help document procedures. Various appendices provide interconnection drawings, troubleshooting and parts lists.

Documentation Standards

This manual uses the following documentation standards:

NOTE

Notes contain important information.

CAUTION

Cautions appear before instructions, which if not followed, could cause damage to the equipment or data loss.

WARNING

Warnings appear for a particular procedure or practice which, if not followed correctly, could lead to serious injury or death.

Text

Hard buttons are depicted in text in **bold** text.

Soft key screen buttons are depicted in **bold** text when part of an action.

Italics is used for emphasis or to indicate screen text.

Hazard and Safety Information

The common international symbols used in this manual and on the equipment are defined below.

OFF Supply (Power)

ON Supply (Power)

AC – Alternating Current

Warning, Risk of danger

Frame or chassis Terminal

Indoor, Dry Location Use Only

Earth (Ground) Terminal

Caution, Hot Surface

Caution, Risk of Electrical Shock

Protective Conductor Terminal

Do Not Place in Trash

Caution, Radio Restriction

Operators and service personnel must be aware of all hazards associated with this equipment. They must know how to recognize hazardous and potentially hazardous conditions, and know how to avoid them. The consequences of unskilled, improper, or careless operation of the equipment can be serious. Every operator or service person must read and thoroughly understand operation/maintenance manuals and any additional information provided by Agilent. All warning and cautions must be read carefully and strictly observed. Consult local, state, and national agencies regarding specific requirements and regulations. Address any safety, operation, and/or maintenance questions to your nearest Agilent office.

Solvents

WARNING

The mechanical components of leak detectors are typically cleaned with alcohol, methanol, or other solvents.

When heated, sprayed, or exposed to high-temperature equipment, these solvents become flammable and explosive, causing serious injury or death. Do not use these solvents near a high-temperature source. Ventilate the working area with a blower and work in a large, well-ventilated room.

Alcohol, methanol, or other solvents are irritants, narcotics, depressants and/or carcinogens. Their inhalation and/or ingestion may produce serious side effects. Prolonged or continued contact with the skin results in absorption through the skin and moderate toxicity. Always ensure that cleaning operations are carried out in large, well-ventilated rooms, and wear eye shields, gloves, and protective clothing.

To clean the leak detector plastic enclosure, the LCD display and Front Panel buttons, use only a soft cloth slightly dampened with water or a mild soap.

Do NOT use excess water or cleaning solvents of any kind.

Avoid splashing any cleaning solvents into the unit through the ventilation openings or Front Panel buttons. Wipe the surface with a dry lint-free cloth.

CAUTION

Do not clean any aluminum parts with Alconox®. Alconox is not compatible with aluminum and will cause damage.

Vacuum Equipment and Cleanliness

Cleanliness is vital when servicing the leak detector or any vacuum equipment. There are some techniques that are more important in leak detector servicing than in general vacuum work:

CAUTION

Do not use silicone oil or silicone grease.

Use powder-free butyl or polycarbonate gloves to prevent skin oils from getting on vacuum surfaces.

NOTE

Agilent does not recommend the use of vacuum grease. Vacuum grease absorbs helium tracer gas and releases this slowly resulting in helium background during leak test operations. If it must be used, use it sparingly and avoid silicone types. Apiezon® L grease is recommended (Agilent Part No. 695400004).

O-ring Care

When removing, checking or replacing O-rings, keep in mind the following:

NOTE

Agilent recommends replacing all O-rings during routine maintenance or during any maintenance procedure requiring that O-rings be removed.

NOTE

Due to the effective cleaning nature of VacuSolv solvent and its residue-free properties, Agilent' Component and Spectrometer Cleaning Kit (Part Number 670029096), used in accordance with the kit instructions, is recommended for cleaning spectrometer components. The kit can also be used for fine cleaning of other parts in the leak detector's vacuum system such as valves and fittings. No rinsing steps or high-temperature drying are required following cleaning with VacuSolv. Although appropriate precautions are advised, VacuSolv is compatible with most materials and does not contain toxic chemicals or CFCs (chlorofluorocarbons). Other acceptable solvents are isopropyl alcohol (IPA) or Dow Corning® OS-20.

CAUTION

Remove O-rings carefully with your fingers. Do not use metal tools for this task; this prevents scratching of any sealing surfaces.

- *Wipe all O-rings clean with a lint-free cloth before installation to ensure that no foreign matter is present to impair the seal.*
- *Do not use grease or any other substance on O-rings that will come in contact with the spectrometer.*
- *Do not use alcohol, methanol or other solvents on O-rings. Doing so causes deterioration and reduces their ability to hold a vacuum.*
- *Agilent does not recommend the use of vacuum grease. If applicable, apply a small amount of Apiezon® L grease and wipe the O-rings shiny dry.*

Metal Seal Care

CAUTION

Metal Seals must be replaced during routine maintenance or during any maintenance procedure required. All fasteners must be installed and torqued per assembly procedure specifications. Remove Metal Seals carefully with your fingers. Do not use metal tools for this task, this prevents scratching of any sealing surfaces. Wear non-powdered, ESD safe Nitride or equivalent gloves prior to removing or replacing Metal Seals.

- ❑ *All Metal Seals come in clean room condition packages. No cleaning is required If necessary, Metal Seals can be cleaned using alcohol or methanol. Wipe all Metal Seals clean with a lint free cloth before installation to ensure that no foreign matter is present to impair the seal.*
- ❑ *Do not use grease or any other substance on Metal Seals that will come in contact with the spectrometer.*

Equipment, General

Environment of intended use:

- ❑ *Indoors use in an industrial and laboratory installation only.*
- ❑ *Altitude up to 2000 m*
- ❑ *POLLUTION DEGREE 2, Material group III*
- ❑ *Operating Temperature: +12 °C to +40 °C, Relative Humidity (RH) up to 90% max.*
- ❑ *Storage ambient conditions: RH from 0% to 95%, non-condensing, temperature: -20 °C to +60 °C*

WARNING

- ❑ *Do not use in presence of flammable or explosive gas.*
- ❑ *Do not attempt to disassemble or modify the equipment. Such action could lead to electric shock or injury. Agilent's authorized technician will do any repair work.*
- ❑ *If there is smoke or unusual smell or noise, stop the using the equipment immediately, and contact the Agilent Service Center.*

WARNING

The leak detector is not designed for use with hazardous gases. Verify that the system to be tested has been purged of all hazardous gases prior to using the leak detector. When testing a system that contained hazardous gases, connect the exhaust of the leak detector to a scrubbed or toxic containment exhaust. Exposure to hazardous gases could result in serious injury or death.

WARNING

Equipment tightness is guaranteed for normal operating conditions when the equipment leaves the factory. It is the user's responsibility to maintain the level of tightness, particularly when pumping dangerous products.

CAUTION

The performance and operating safety of this equipment can only be guaranteed if it is operated according to normal conditions of use.

Allow at least 4" of clearance adjacent to the ventilation slots at the front, sides and back of the equipment enclosure.

Allow sufficient room for the operator to safely maneuver to perform testing.

LCD Display

WARNING

If the LCD display breaks, avoid getting any liquid crystal in mouth or eyes. If it gets on the operator hands, feet or clothing, wash it immediately with soap and water.

CAUTION

Do not apply excessive pressure to the LCD display as this may cause smears.

In general, the lower the temperature, the longer it takes the LCD display to turn on. Performance of the LCD display may deteriorate in low temperature.

Radio

The Wireless Remote Control is built around an Aerocomm, model AC4424-100, RF transceiver module operating in 2.4 GHz ISM band. The same type of the RF module is built in a VS Series Leak Detector Wireless Base Station PCB and Wireless Remote unit (see *VS Series Leak Detector Wireless Remote Operational Manual* (6999099945A)).

Agency Identification Numbers for Aerocomm, Model AC4424-100:

- ❑ US/FCC ID: KQL-AC4424
- ❑ CAN/IC: CAN2268C391190A
- ❑ EUR/EN: CE

are also applied to the Agilent's Wireless Remote and VS Series Leak Detector Wireless Base Station, when the units are used the approved antennas.

WARNING

The Wireless Remote complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

To satisfy FCC RF exposure requirements for mobile type transmitting devices, maintain a separation distance of 20 cm or more between the antenna of the Wireless Remote and persons during operation, with exception of hands wrist, feet, and ankles. To ensure compliance, operations at closer distance than this distance are prohibited.

Maintain a separation distance of 20 cm or more between the operator and the RF antenna of the VS Series leak detector with a wireless base station.

CAUTION

Use only approved type of antennas for:

- ❑ Wireless Remote: Centurion, Model WCP2400-MMCX2, www.centurion.com.
- ❑ VS Series Leak Detector Wireless Base Station, Nearson, Model S181FL-5-RMM- 2450S, www.nearson.com

Power and Static Sensitivity

WARNING

Depending on the unit configuration ordered, the mains power supply requirements for VS Series leak detectors are:

- ❑ *100 VAC, 50 Hz, 20 A*
- ❑ *115 VAC, 60 Hz, 20 A or*
- ❑ *230 VAC, 50/60 Hz, 12 A*

Before powering the unit for the first time, verify that the unit is configured to operate for the local mains supply voltage.

CAUTION

Use surge protection to improve the immunity of the leak detector against unidirectional transients caused by the following phenomena:

- ❑ *Switching phenomena in the power network (e.g., switching of capacitor banks, inductive loads, electrical motors, etc.)*
- ❑ *Faults in the power network*
- ❑ *Indirect lightning strokes*

CAUTION

Many components of the leak detector are static sensitive. Wear a grounding device when performing any maintenance on the leak detector, especially when performing maintenance of static sensitive parts, such as circuit boards and the spectrometer.

CAUTION

This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when it is operated in a commercial environment.

This equipment generates, uses, and can radiate RF energy, which if not installed and used in accordance with the instructional manual, can cause harmful interference to radio communications.

When this equipment is operated in a commercial environment, operation is subject to the following two conditions:

- *This equipment must not cause harmful interference.*
- *This equipment must accept any interference received, including interference (RF and ESD) that may cause undesired operation.*

The equipment may need to be reset after RF and/or ESD events by cycling the Power Switch/Circuit Breaker on the back panel of the unit.

Operation of this equipment in a residential area is also likely to cause harmful radio communications interference, in which case, the users will be required to correct the interference at their expense.

WARNING

This equipment is designed to meet current EEC regulations: LVD (Low Voltage Directive, 73/23/EEC:1993) and EMC (Electromagnetic Compatibility Directive, 89/336/EEC:1993) for Material Group III, Pollution Degree 2 environment for Industrial, Scientific, Measuring and Process Control Electrical Equipment and R&TTE (Radio and Telecommunications Terminal Equipment Directive, 199915/EC:1999)

- *Any modifications on the part of the user are liable to cause non-compliance with regulations or affect the EMC performance and the safety of the product. Agilent cannot be held responsible for consequences resulting from such intervention.*
- *Before powering the unit the first time, verify that the unit is configured to operate for the local mains supply voltage.*
- *The equipment can be damaged by:*
  - *Incorrect mains AC supply voltages*
  - *Radio Frequency (RF) and Electrostatic Discharge (ESD) energy inputs that exceed the maximum ratings*
  - *Operating in very high temperatures or without adequate ventilation*
  - *Immersion in liquids*
  - *Physical abuse*
- *All electrical connections must be performed by a qualified electrician and must comply with national and local codes.*
- *Opening the enclosure may expose hazardous voltages. Always disconnect the power cord and interface cables before opening the enclosure. Do not touch the power inlet's contacts for at least 10 seconds after disconnecting the power cord.*
- *Electrical installation must include the appropriate branch circuit (20 A maximum), with a long time delay and a reliable earth ground.*
- *Use only the power cord that was provided with your leak detector. The use of extension cords is not recommended and could result in damage to the equipment and loss of warranty.*
- *To avoid electric shock, connect the product power cord to a grounded power receptacle. A power cord with a grounding conductor is required.*

Spectrometer

WARNING

Store the Ion Source/Preamplifier sub-assembly in a cool, dry area in a tightly sealed, ESD protected container. Wear lint-free gloves when handling the spectrometer. Wash hands thoroughly after handling the spectrometer filaments and especially before smoking or eating.

CAUTION

The spectrometer operates at a very high vacuum produced by the high vacuum pump. Service of the spectrometer requires that this vacuum be vented to the atmosphere.

CAUTION

Do not use grease or any other substance on O-rings or metal seals that will come in contact with the spectrometer.

CAUTION

If the spectrometer magnet comes in contact with a magnetic surface, the magnet can become degraded causing the spectrometer to lose sensitivity.

Pumps

WARNING

To avoid injury, use proper lifting techniques when moving pumps. Two people may be required to move pumps safely.

WARNING

The vacuum pumps are also compressors; incorrect operation may be dangerous. Study the Mechanical Pump Operation Manual enclosed with your pump before starting pumps.

The pumps are designed to prevent any thermal risk for user safety. However, specific operating conditions may generate temperatures >70 °C.

Hot oil burns the skin. Service of the pumps in this area must be performed by authorized personnel only. Stand back from a mechanical pump before starting it.

WARNING

To avoid injury, wait until the turbo pump is completely stopped before disconnecting it from the vacuum system.

To vent the turbo, open the knurled vent screw located on the side of the turbo. If the turbo is spinning, you will hear it wind down. Close the vent screw after the turbo has stopped.

CAUTION

*Check the oil level often. Do not allow oil-based mechanical pumps to run when the oil level is below the **LOW** mark. Damage to pumps can occur if operated with no oil, if the oil level is too high or if the oil has become discolored.*

Agilent Services

Agilent offers:

- ❑ Rebuilt spectrometers on an exchange basis
- ❑ NIST-traceable calibrated leak testing and verification services
- ❑ Preventive maintenance services
- ❑ Overhaul services
- ❑ System recertification
- ❑ Support agreements
- ❑ On-site support

Please see our catalog or contact us to learn about available services.

Contacting Agilent

In the United States, you can contact Agilent Customer Service at 1-800-882-7426. See the back cover of this manual for a listing of our sales and service offices.

Visit our web site at: http://www.chem.agilent.com/en-US/Products/Instruments/vacuum/pages/default.aspx.

Tools Required for Component Replacement

Each procedure lists the tools required for that component replacement.

Materials Required for Component Replacement

- ❑ Powder-free butyl or polycarbonate gloves
- ❑ Clean, non-magnetic surface
- ❑ Lint-free wipes
- ❑ VacuSolv or similar solvent
- ❑ Cotton swabs
- ❑ Loctite PST 565 Thread Sealant

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Section 1. Introduction to the VS Series Leak Detector

1.1 The VS Series Leak Detector

The VS Series is a wide-range Helium Mass Spectrometer Leak Detector, which is comprised of a turbo molecular high vacuum pump, internal mechanical rough pump (model VS PR02 and PD03), external mechanical rough pump (models VS MR15, VS MD30, VS BR15 and VS BD30), spectrometer tube, valve block, leak detector electronics, an operator interface (TFT-LCD display with a touch panel and two hard buttons: TEST and VENT), and optional features, including:

- Wireless remote control that is includes:
  - Wireless Base PCB (P/N R2541301) installed in a VS leak detector
  - Wireless Remote unit (P/N R3000301).
- Optional I/O PCB (P/N R2111301).

Both models VS MR15x and VS MD30x include an optional two-wheel cart.

All models are available in 100/115 VAC and 230 VAC configurations (see Table 1-1 on page 1-2).

The wireless remote control has the following capabilities:

- RF communication between VS leak detector (Base Station or Host) and the Wireless Remote unit from the distance up to 100 m (300 ft).
- Enter the VS leak detector unit into Test and Hold modes from the Wireless Remote unit keypad.
- Read the VS leak detector unit's leak rate in a linear and logarithmic bar graph format with a numeric range indicator and System status in alphanumeric format on the Wireless Remote unit LCD display.
- Configure up to ten different VS leak detector units for wireless control by toggling through a MAC address list using one Wireless Remote unit.

The optional I/O PCB compromises:

- Optically isolated parallel I/O (DB25 female connector with 12 output and 8 input lines) to use with an external PLC and should be powered by the user (+5-24 VDC) via a cable with length less than 10′ and provided by the user (see Appendix A.3.1 “Serial Connector” on page A-13).

CAUTION

The usage of a longer cable for the parallel I/O output connection with an external PLC is fully responsibility of the user. Some EMC prevention measure may be required by the user

- ❑ USB HUB with two downstream type A connectors and one upstream type B connector.

NOTE

USB features are SW disabled in this release.

Table 1-1 VS Series Leak Detector Configurations and Part Numbers

Model Number	Agilent P/N	Mains Voltage	Vacuum Pump System		Configuration	Two Wheel Cart
			Internal	External		
VS PR02	VSPR021	100/115 VAC	DS-42	N/A	Portable	N/A
	VSPR022	230 VAC				
VS MR15	VSMR151	100/115 VAC	N/A	DS302	Mobile	Yes
	VSMR152	230 VAC				
VS MD30	VSMD301	100/115 VAC	N/A	TS620	Mobile	Yes
	VSMD302	230 VAC				
VS BR15	VSMR151	100/115 VAC	N/A	DS302	Bench Mount	N/A
	VSBR152	230 VAC				
VS BD30	VSBD301	100/115 VAC	N/A	TS620	Bench Mount	N/A
	VSBD302	230 VAC				
VS PD03	VSPD030	110 VAC	IDP-3	N/A	BR/NBL	N/A
	VSPD031	115 VAC				
	VSPD032	220 VAC				

Outline drawings for each configuration are shown in Section 1.1.1 “VS Series Leak Detector Configurations”.

1.1.1 VS Series Leak Detector Configurations

This section contains outline drawings of the leak detector configurations. Dimensions are given in inches, in brackets, and in mm, below the brackets.

Figure 1-1 shows the outline drawing and physical dimensions of the portable leak detector with Internal DS42 Wet Rotary Vane Pump, Model VS PR02 and the PD03, which utilizes a Agilent IDP-3 dry pump.

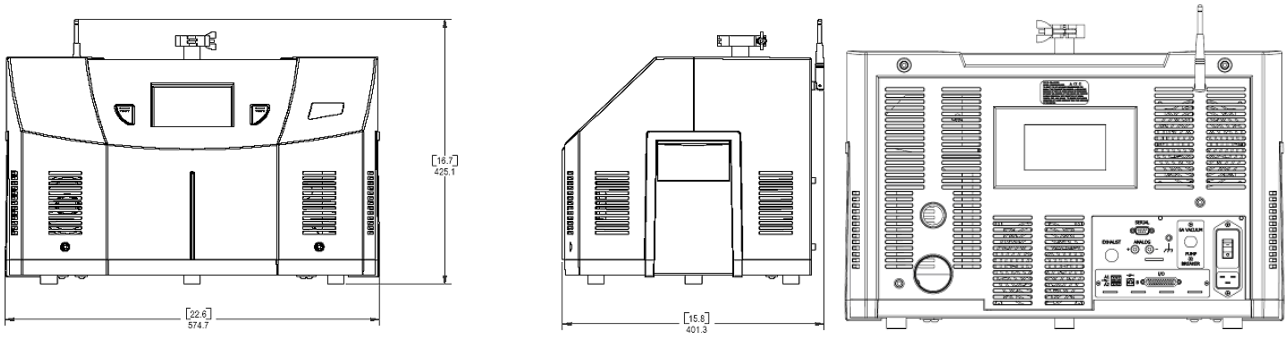

Figure 1-1 Portable Leak Detector with Internal DS42 Wet Rotary Vane Pump, Model VS PR02, and Portable Leak Detector with Internal IDP-3 (PD03) Dimensions

Figure 1-2 shows the outline drawing and physical dimensions of a mobile leak detector with External DS302 Wet Rotary Vane Pump on a Cart, Model VS MR15.

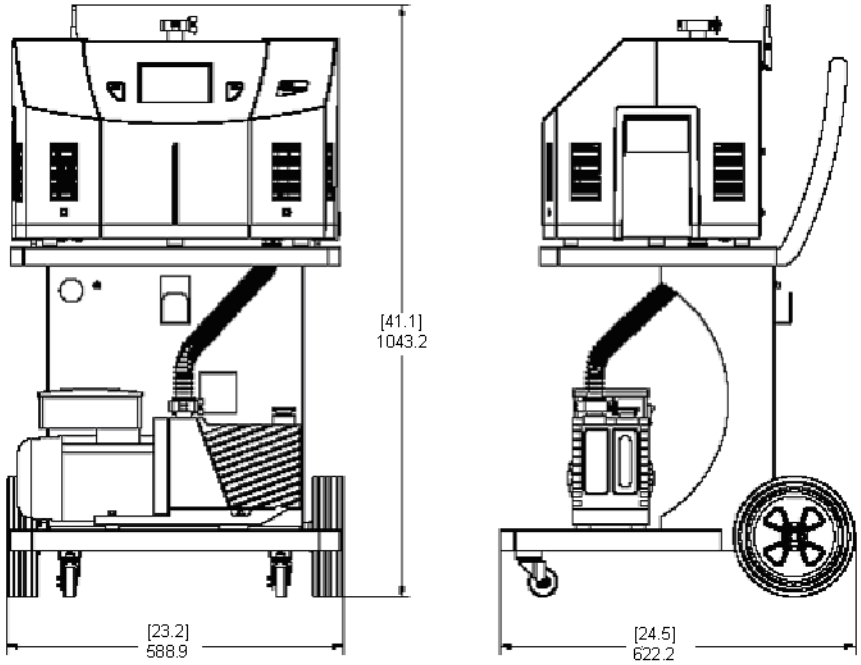

Figure 1-2 Mobile Leak Detector with External DS302 Wet Rotary Vane Pump on a Cart, Model VS MR15, Dimensions

Figure 1-3 shows the outline drawing and physical dimensions of a Mobile Leak Detector with External TS620 Dry Scroll Pump on a Cart, Model VS MD30.

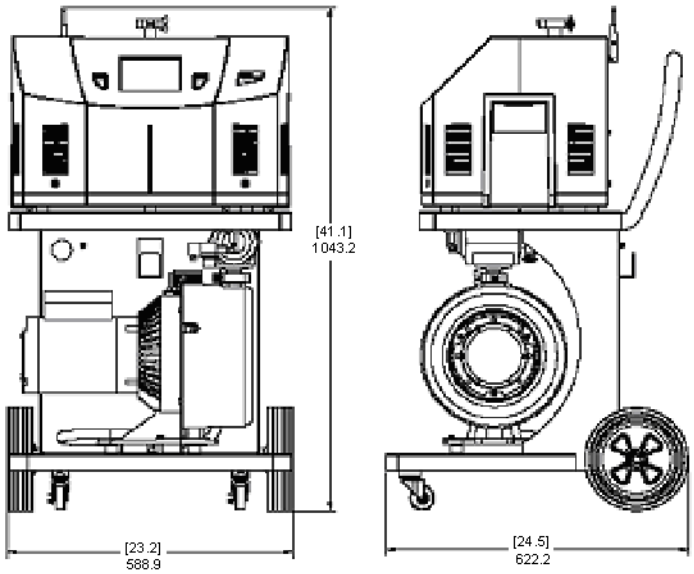

Figure 1-3 Mobile Leak Detector with External TS620 Dry Scroll Pump on a Cart, Model VS MD30, Dimensions

1.2 Front Panel Display and Controls

The front panel (Figure 1-4) consists of two *hard* buttons: **TEST** and **VENT** and an LCD display to access the software control screens. All operator control and monitoring of results are achieved via the resident software accessed using the Home screen. Table 1-2 on page 1-8 lists the main sub-screens and their purpose.

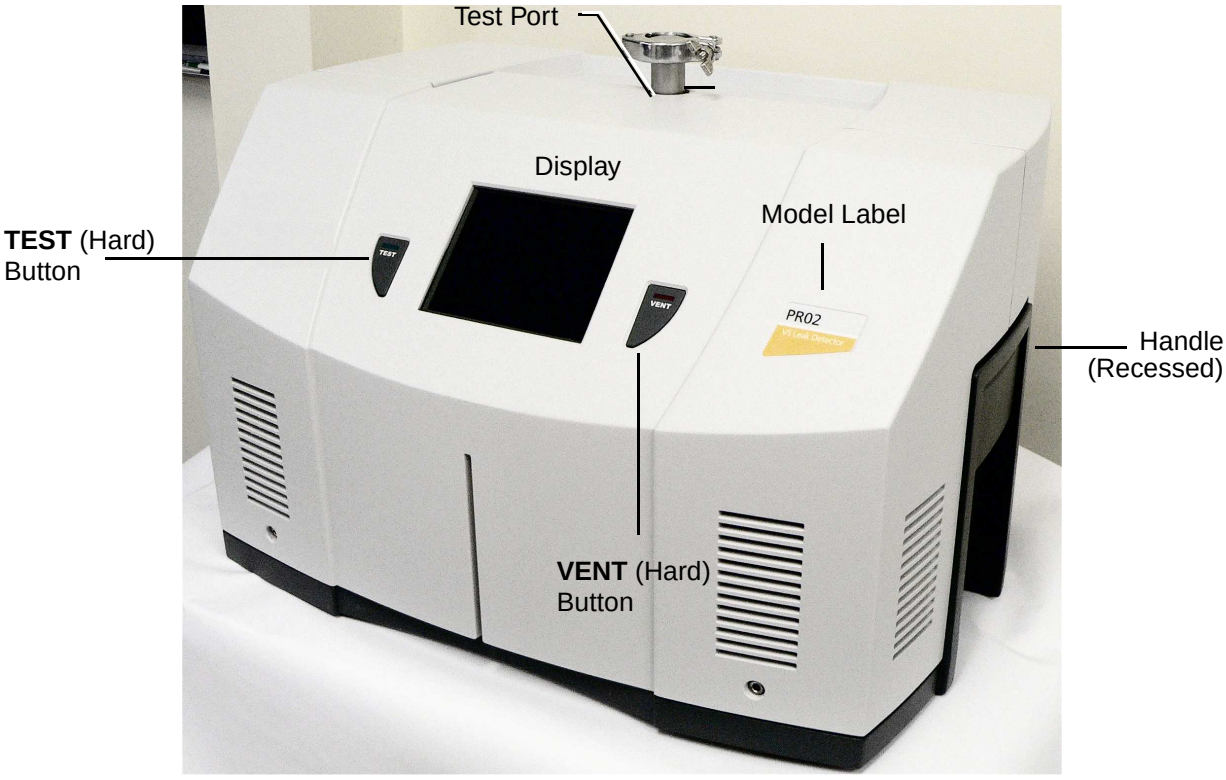

Figure 1-4 Front Panel Displays and Controls

The front panel display touch panel is calibrated at the factory and should not require recalibration. If the touch panel buttons do not respond to pushes, recalibrate as follows:

1. Turn off the leak detector power.
2. Press and hold the center of the touch panel and restart power.

   A blue screen appears.
3. Press the four cross hairs on the screen and accept the calibration.

LCD Display

Represents:

- ❑ Leak Rate - in a Bar Graph format with a numeric range indicator
- ❑ Leak Rate, System Status and Parameters - in alphanumeric format
- ❑ Series of screens with the soft key buttons for operator interface

Leak Rate, System Status and Parameters in alphanumeric format:

- ❑ Leak Rate is presented in a scientific notation: XXE-YY with appropriate units
  Where: X .X mantissa is a leak rate value
  E- Y = 10-YY exponent is a leak rate range
  X and Y are any numbers from 0 to 9
- ❑ System Status and/or Mode are represented on the screen in alpha format on the screen and an italic font in this manual
- ❑ Parameters are represented on the screen in alphanumeric format a bold font in this manual.

Leak Rate Bar Graph

The large bar graph displays the leak rate in one of three forms:

- ❑ A linear bar graph
- ❑ A logarithmic bar graph
- ❑ Both linear and logarithmic bar graphs

Use the Output Control Set-Up screen to change the type of bar graph that appears.

Over-range and under-range conditions are indicated using two up and down arrows on the right and left side of the bar graph, respectively.

VENT

The **VENT** button advances the leak detector to the vented state. A red LED illuminates while the leak detector is in the vented state.

TEST

When the system is in the Vent or Hold states, pressing the **TEST** button automatically advances the leak detector through roughing, then through the various test states, depending on the achievable test port pressures and leak rates. A green **TEST** LED in the button illuminates when the leak detector is in a Test state.

Press the **VENT** button to isolate the test port from the leak detector vacuum system and vent the test port to atmosphere. The red **VENT** LED remains lit while the leak detector is in the vented state. To activate the VENT function, press and hold **VENT** for one second.

The leak detector operator interface functions through a series of screens, which are navigated as in Figure 1-5.

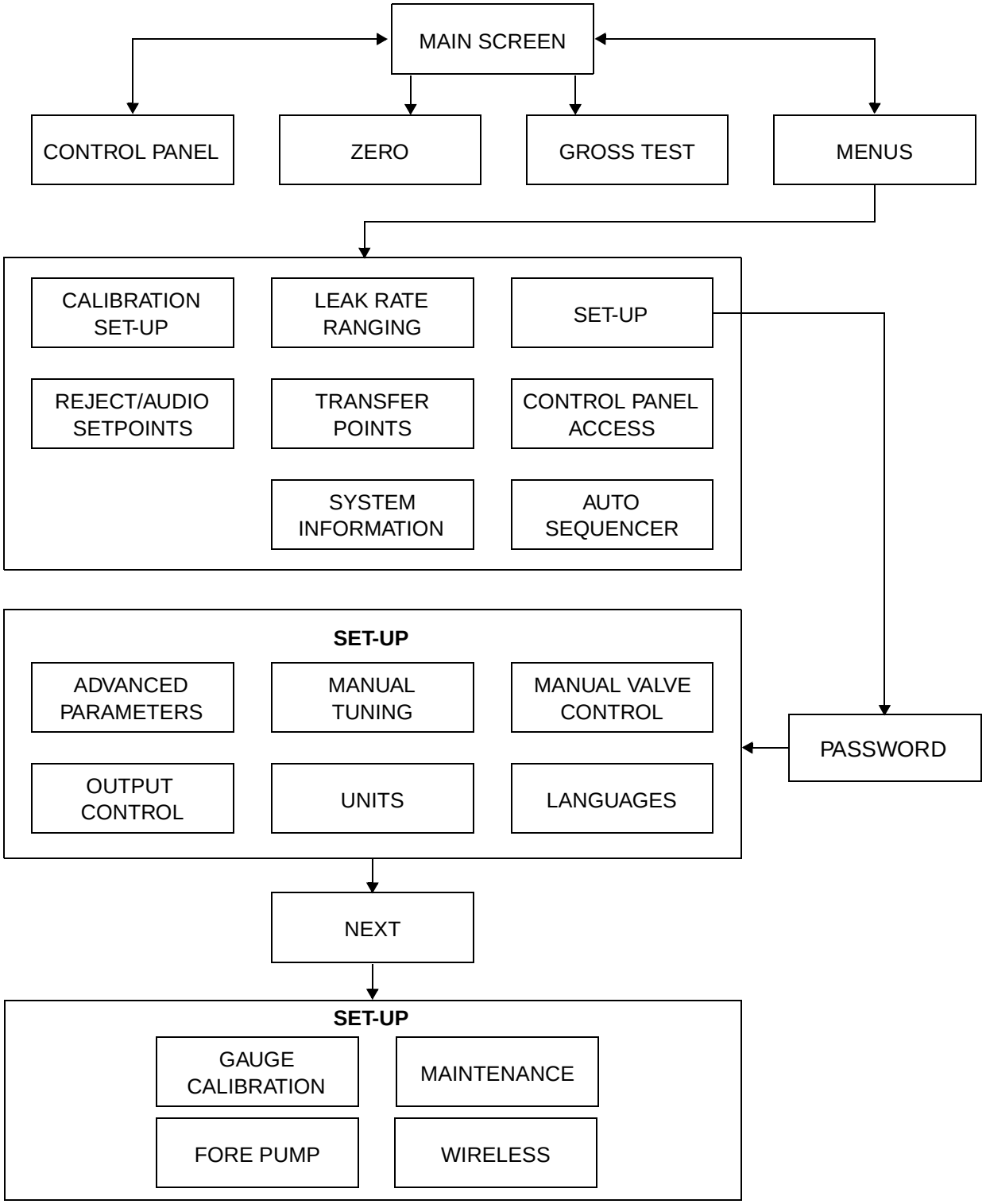

Figure 1-5 Screen Flow

1.3 Display Panel Controls

Table 1-2 Screens – General Description

Screen	Purpose
Home	Accesses the Control Panel and Menu screens. Activates the Zero function. The LED illuminates while zeroing occurs. Accesses the Gross Leak Test screen, when Gross Test is pressed.
Control Panel	Activates/deactivates: ❑ Std Leak ❑ Zero Enable ❑ Hold ❑ Calibrate Displays the type of leak: Internal or external, associated with Calibrate. Adjusts the speaker volume.
Menus	Accesses the following screens for tailoring leak detector operation: ❑ Calibration Set-Up – Configures leak type, mode and parameters. ❑ Reject & Audio Set Points – Configures parameters and toggles operations on/off for each reject set point and for the audio threshold. ❑ Leak Ranging – Configures the Range Stop, Manual Range values, toggles the high pressure test feature and toggles operations on/off. ❑ Transfer Pressure – Configures the Maximum Test Pressure. ❑ System Information – Displays the status of configured and active items. ❑ Control Panel Access – Activates/deactivates Vent and Panel Lockouts. ❑ Auto Sequencer – Configures roughing and test times, toggles features on/off and displays rough timer value. ❑ Set-Up - Accesses all the screens shown in Figure 1-5 on page 1-7.

Table 1-2 Screens – General Description (Continued)

Screen	Purpose
Set-Up	Accesses the following screens: ❑ Advanced Parameters: ❑ Activates Autozero and Split Flow functions. ❑ Activates the Gross Leak function. ❑ Sets Split Flow value. ❑ Output Control – Configures the Analog Output and Bar Graph default units. ❑ Manual Tuning: ❑ Toggles between Filament 1 and 2. ❑ Sets Emission, Ion and Gain settings. ❑ Units – Configures Leak Rate and Pressure units. ❑ Manual Valve Control – Access to control all valves. ❑ Languages – Configures language. ❑ Gauge Calibration – Calibrates the Test Port Vacuum and Test Port ATM reference points and displays Test Port Pressure and Spectrometer Pressure. ❑ Maintenance – Configures: ❑ Date and Time ❑ Cal Leak Expiration and Internal Calibrated Leak values ❑ Password. ❑ Fore Pump. ❑ Wireless.

1.4 Rear Panel

The rear panel of the leak detector with an external mechanical pump (Model VS MR15 or MD30) and a wireless remote control option is shown in Figure 1-6.

Figure 1-6 VS Series Rear Panel

① Serial Connector — A 9-pin male D-type connector to interface with an external PC via RS-232 type communications protocol for system diagnostic or control.

A detailed summary of information related to serial communication is provided in Appendix A “Communications Protocol” on page A-1.

② Cover Plate — Access to expansion slot. This is not used when an optional I/O PCB is installed. A rear panel of the optional I/O PCB is shown in Figure 1-7 on page 1-11.

③ Power Entry Module	Provides supply power, overcurrent and EMI protection for the leak detector. The Power Entry Module consists of: ❑ Power Input Connector - An IEC/EN60320/C20 standard, three-prong grounded Inlet connector. ❑ Power Switch (I/O) - A 20A rocker type Power Switch/Thermal Circuit Breaker. ❑ 20 A EMC line filter.
④ Fore Pump Power Connection	An IEC/EN60320/C19 standard, three-prong grounded outlet connector.
⑤ Analog Output	Banana type output connector for an Isolated Leak Rate Analog reading. The Red connector is a signal positive terminal; black is the signal negative terminal. Signal range: From 0 to +10 VDC.
⑥ Chassis (Earth) Terminal	Provided for additional connection of the leak detector to the building grounding system to improve ESD protection.
⑦ Product Label	A product label with part number, serial number and rating information.
⑧ RF Antenna	A swirl 2.4 GHz antenna for the optional Wireless Remote Control-Standard USB connector.
⑨ Exhaust Cover	Exhaust opening for a VS PR02 model.
⑩ Oil Level Cover	Oil level window for a VS PR02 model.
⑪ Oil Drain Cover	Oil drain opening for a VS PR02 model.
Test Port	Test port adapter (not shown).
2-Wheel Cart	2-wheel cart for an external fore pump (not shown)
Wireless Label	A wireless info label for VS leak detector with an optional Wireless Remote Control.

A rear panel for the optional I/O PCB assembly is shown in Figure 1-7.

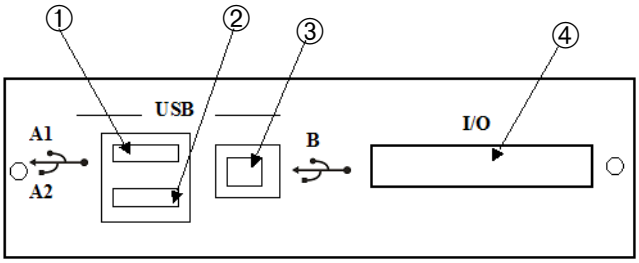

Figure 1-7 Optional I/O PCB Rear Panel

① USB - A1	USB 1.1 full speed downstream port, USB type *A* receptacle.

② USB - A2	USB 1.1 full speed downstream port, USB type *A* receptacle.
③ USB - B	USB 1.1 full speed upstream port, USB type *B* receptacle.
④ I/O Connector	A 25-pin female D-sub connector to interface with an external PLC via a parallel cable.

Inputs:

- ❑ Four level inputs: optically isolated, (+5 to+24) VDC.
- ❑ Four momentary inputs: optically isolated, (+5 to+24) VDC, requires 200 ms pulse width.

All inputs are opto-isolator LEDs with a series 3300 Ohm resistor.

Outputs:

- ❑ Eight optically isolated emitter followers with a 10 Ohm series resistor, 14 mA max drive current, +24VDC max.

Power:

- ❑ An external power supply is supplied by the user.

A detailed summary of information related to I/O pin identifications is provided in the VS Series User Guide.

The rear panel of the leak detector (Model VS PR02 and PD03) is shown in Figure 1-8. The optional Wireless remote control and I/O PCB is not installed.

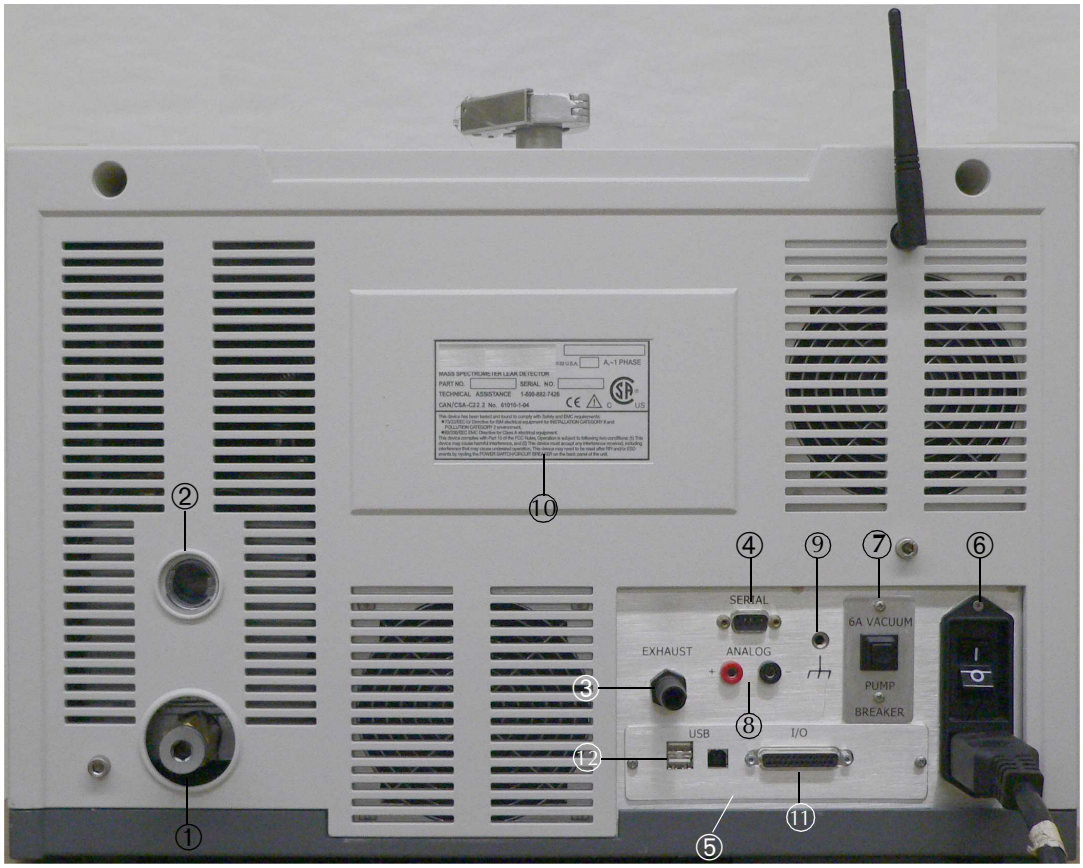

Figure 1-8 Rear Panel (with Discrete I/O PCB)

① Oil Drain	For the internal mechanical vacuum pump.
② Glass Window	Oil level sight glass reading.
③ Exhaust	A barbed hose fitting (OD = 12.57 mm) for exhaust of the internal mechanical vacuum pump.
④ Serial Connector	A 9-pin male D-type connector to interface with an external PC via RS-232 type communications protocol for system diagnostic or control A detailed summary of information related to serial communication is provided in Appendix A “Communications Protocol” on page A-1.
⑤ Cover Plate	Access to expansion slot.

⑥ Power Entry Module	Provides supply power, overcurrent and EMI protection for the leak detector. The Power Entry Module consists of: ❑ Power Input Connector - An IEC/EN60320/C20 standard, three-prong grounded inlet connector. ❑ Power Switch (I/O) - A 20A rocker type Power Switch/Thermal Circuit Breaker. ❑ 20 A EMC line filter.
⑦ Vacuum Pump Breaker	A 6 A Thermal Circuit Breaker for the internal mechanical pump.
⑧ Analog Output	Banana type output connector for an Isolated Leak Rate Analog reading. The Red connector is a signal positive terminal; black is the signal negative terminal. Signal range: From 0 to +10 VDC.
⑨ Chassis (Earth) Terminal	Provided for additional connection of the leak detector to the building grounding system to improve ESD protection.
⑩ Product Label	A product label with part number, serial number and rating information.
⑪ 25 Pin I/O	❑ Inputs: Opto-isolated, 5 - 24 VDC 3300 Ohm resistive load. All inputs are opto-isolator LEDs with series resistors. ❑ Momentary Inputs: Opto-isolated, 5 - 24 VDC 3300 Ohm resistive load, requires 200 ms minimum pulse width. ❑ Outputs: Emitter follower with 10 Ohm series resistor, 14 mA max drive current, 24 VDC max.
⑫ USB	Standard USB connector (types USB *A* and USB *B*).

Section 2. Cleaning the Test Port

The test port is located on the outside of the leak detector. Therefore, it is not necessary to turn the leak detector off or disconnect it from mains power if this is the only procedure being performed. If you are cleaning the test port in conjunction with other procedures that require opening the leak detector, be sure to turn the leak detector off and disconnect it from mains power.

The NW-25 uses the blank-off flange cap on top of the centering ring when the system is not in use or when in use but not connected to a device.

To clean the test port:

1. Turn the test port wing nut counterclockwise to loosen it (Figure 2-1), remove the quick clamp (Agilent p/n KQ25AWP) from the test port, and remove any connected devices.

CAUTION

Be careful not to drop the test port blank-off flange cap when you remove the test port tightening nut. It is deceptively heavy for its size.

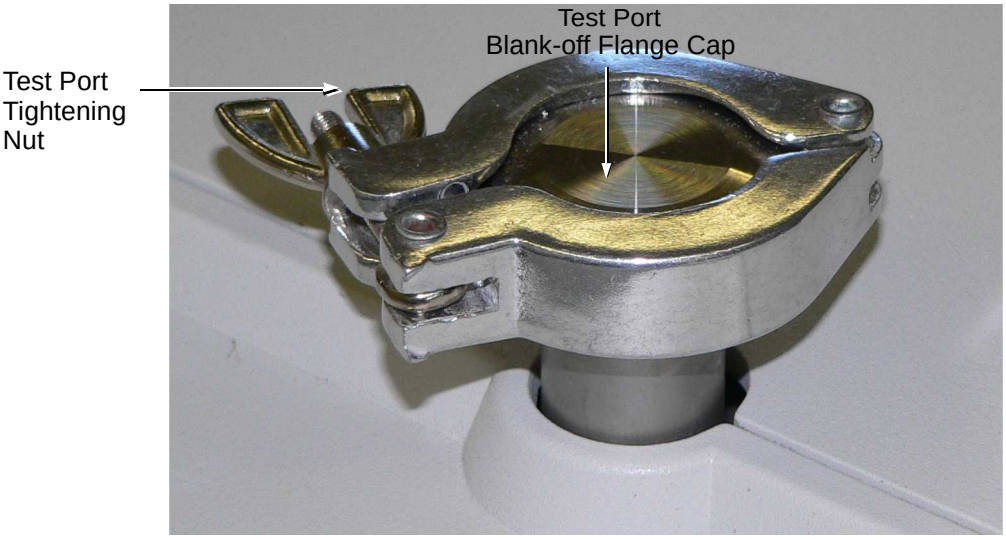

Figure 2-1 Test Port with Blank-Off Flange Cap

2. Remove the test port blank-off flange cap and/or centering ring from the top of the test port (Figure 2-2).

Figure 2-2 Centering Ring with O-ring

3. Remove the O-ring from the centering ring.
4. Examine the O-ring for wear.

   If necessary, use a new O-ring, otherwise clean the O-ring.

NOTE

Agilent recommends replacing all O-rings during routine maintenance or during any maintenance procedure requiring that O-rings be removed.

CAUTION

Remove O-rings carefully with your fingers. Do not use metal tools for this task. This prevents scratching of any sealing surfaces.

Do not use alcohol, methanol or other solvents on O-rings. To do so causes deterioration and reduces their ability to hold a vacuum.

Wipe all O-rings clean with a lint-free cloth before installation to ensure that no foreign matter is present to impair the seal.

If applicable, apply a small amount of Apiezon L grease and wipe the O-rings shiny dry.

5. Examine all parts of the test port, including inside the test port.

   In necessary, use a VacuSolv wipe to remove any dirt or foreign matter and allow parts to air dry.
6. Place the O-ring into the groove of the centering ring.

7. Place the centering ring onto the top of the test port (Figure 2-3).

Figure 2-3 O-ring and Centering Ring on Test Port

8. Replace the blank-off flange cap or connected device.
9. Replace the quick clamp onto the test port and tighten the wing nut clockwise until it is just tight enough to stay in place.

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Section 3. Internal Calibrated Leak Replacement

3.1 Recalibrating the Internal Calibrated Leak

Helium calibrated leaks typically degrade at 3 percent per year. Check the calibrated leak supplied with your leak detector at least once a year to ensure it is at the value stated on its tag. Failure to check the leak could result in unreliable testing. You can arrange for testing and recalibration at a lab of your choice.

Agilent provides NIST-traceable calibrated leak testing and verification services. You can contact Customer Service at 1-800-882-7426 to arrange for recalibration.

3.2 Replacing the Internal Calibrated Leak

3.2.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Slotted Screw Driver

For clarity, some items have been omitted from views.

WARNING

Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 3-1) and detach the rear plastic cover from the unit.

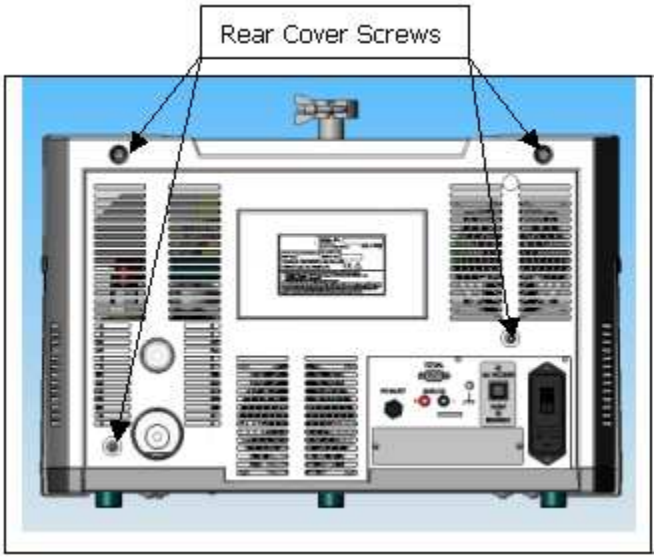

Figure 3-1 Rear Cover Screws

4. Carefully disconnect the calibrated leak temperature cable from the calibrated leak PC board.
5. Using a slotted screwdriver, remove the two screws holding the calibrated leak in place (Figure 3-2).

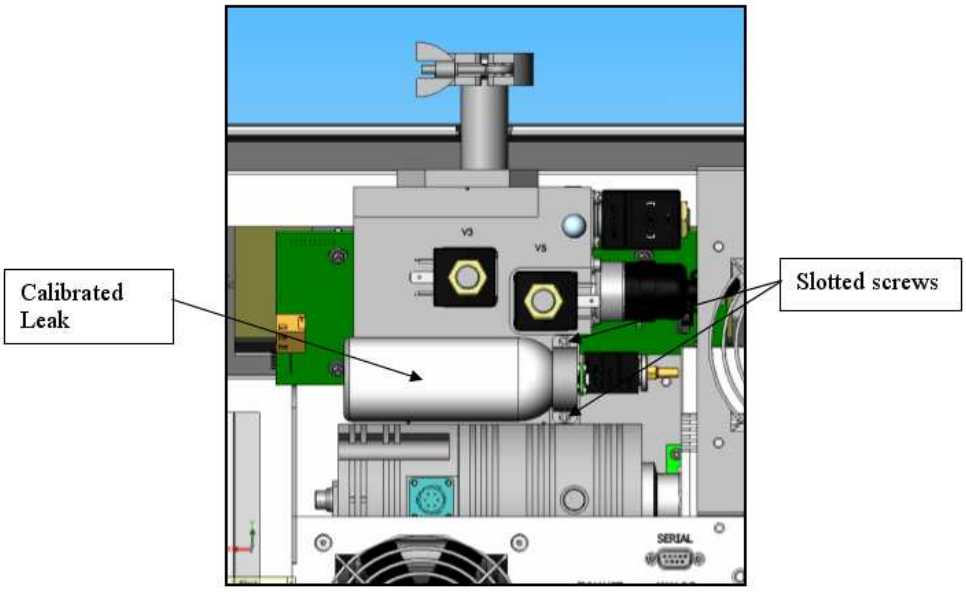

Figure 3-2 Calibrated Leak Location

6. Discard the calibrated leak and the O-ring.
7. Inspect the replacement calibrated leak and O-ring for damage or particle contamination and remove any particle contamination.

8. Install the O-ring in the groove and then assemble the replacement calibrated leak to the valve block using a slotted screwdriver (Figure 3-2).
9. Reconnect the calibrated leak temperature cable to the replacement calibrated leak.

WARNING

Extreme care must be taken due to the presence of high voltage. Ensure that high voltage shield and front cover are in position before proceeding (Figure 3-3).

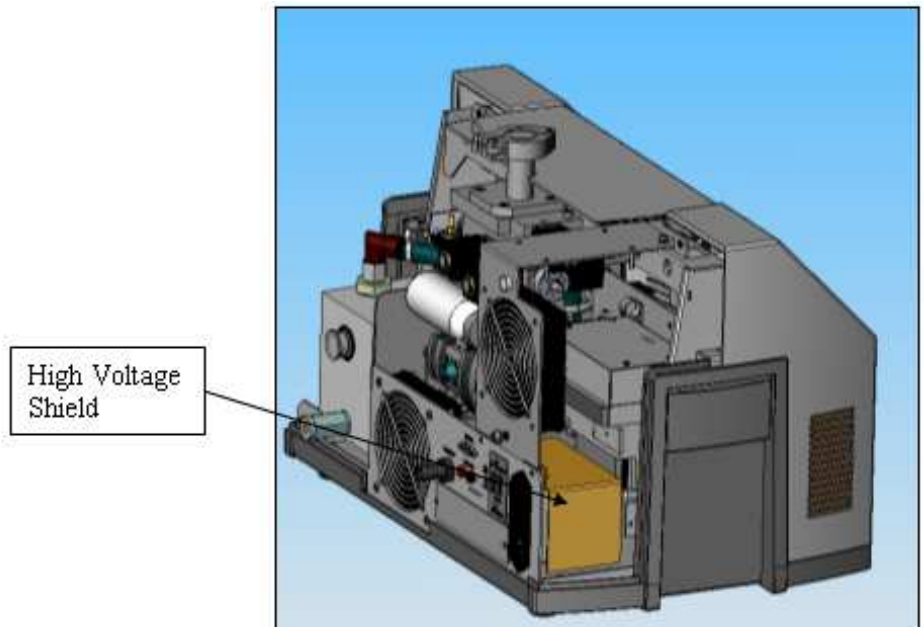

Figure 3-3 High Voltage Location

10. Connect the power cord and power up the unit.
11. Watch the Home screen to verify that the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the System Ready mode.
12. Leak check the calibrated leak O-ring to ensure a leak free joint between the atmosphere and the vacuum space inside.
13. Refer to the *Internal Calibrated Leak and Cal Leak Expiration Set-Up* of the user's manual for the correct calibration procedures for the calibrated leak.
14. Attach the rear cover and secure it to the frame using existing hardware.
15. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 4. Valve Block (Turbo) and Spectrometer Assembly Removal

4.2.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ M5 Allen Wrench
- ❑ Phillips Screw Driver
- ❑ Slotted Screw Driver

Replacing the spectrometer is comprised of:

1. Section 4.1 “Removing the Covers”
2. Section 4.2 “Removing the Valve Block Wiring Harness” on page 4-3
3. Section 4.3 “Removing the Valve Block Assembly and Spectrometer” on page 4-4
4. Section 4.4 “Replacing the Turbo Pump, Valve Block and Spectrometer” on page 4-9
5. Section 4.5 “Replacing the Valve Block Harness and Thermocouple Wiring” on page 4-9

4.1 Removing the Covers

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 4-1) and detach the rear plastic cover from the unit.

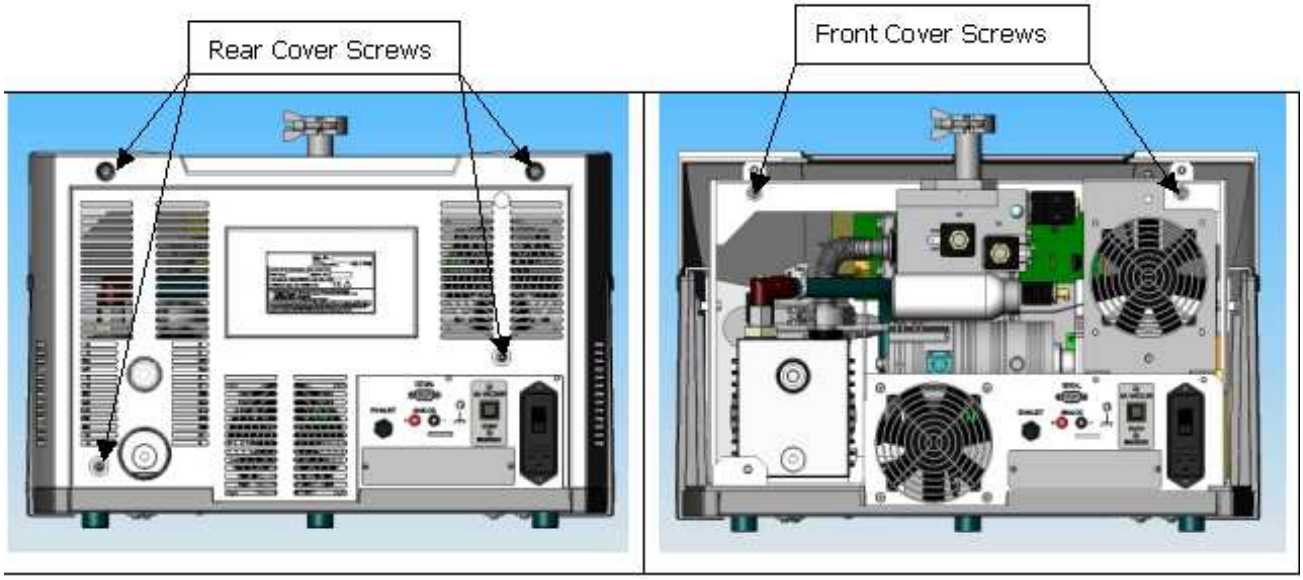

Figure 4-1 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 4-1).

4.2 Removing the Valve Block Wiring Harness

The valve block wiring harness is comprised of seven three-prong sensor blocks labeled: V1 through V5 and V7 and the thermocouple. See the wiring diagram on Appendix E “Interconnection Diagram”.

To remove the valve block wiring harness:

1. Remove the valve pug or connector, unscrew the Phillips head screw and remove the wires from the six three-prong connector (Figure 4-2).

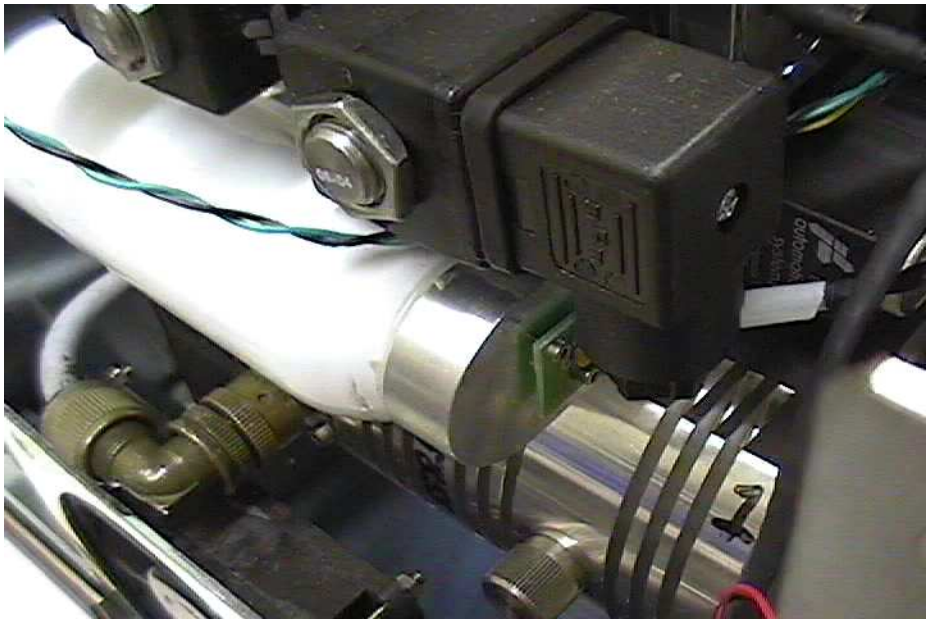

Figure 4-2 Sensor Wiring and Thermocouple

2. Unplug the thermocouple octal connector (Figure 4-3).

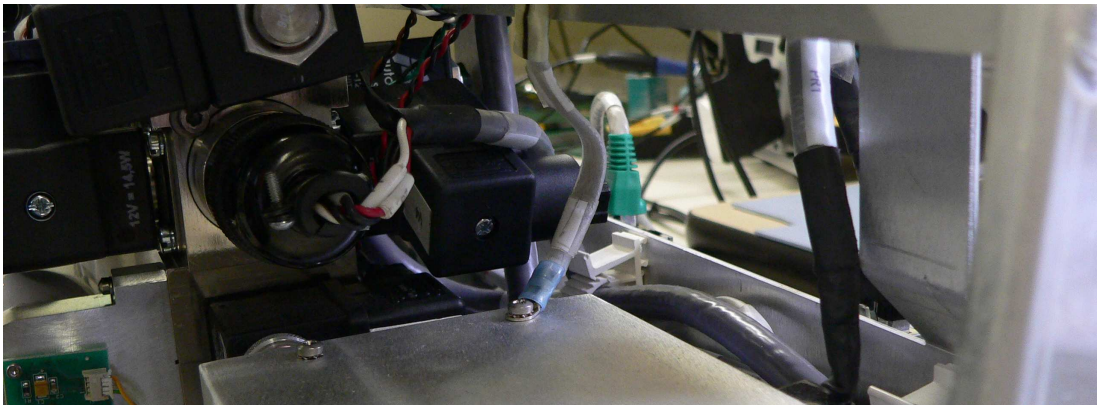

Figure 4-3 Thermocouple

4.3 Removing the Valve Block Assembly and Spectrometer

To remove the valve block:

1. Unscrew the Phillips head screw connecting the test port ground wire to the center rail (Figure 4-4).

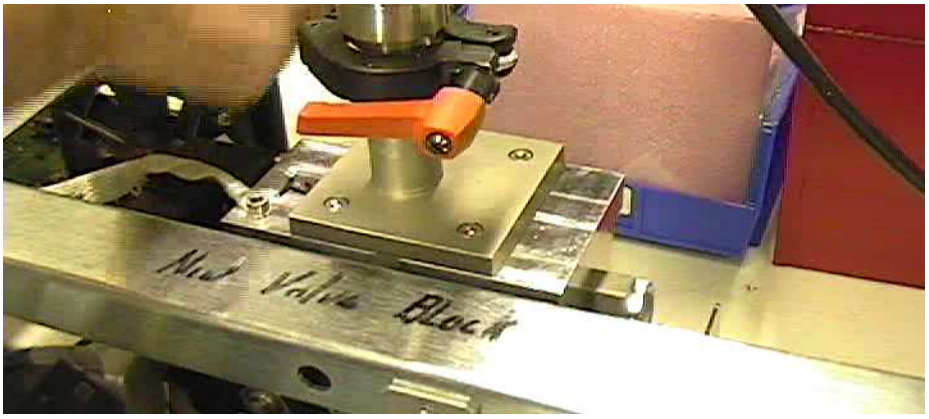

Figure 4-4 Test Port Grounding Wire Connection

2. Loosen, but don't remove, the two bolts for the foreline to valve block connection. Take care not to damage the O-ring (Figure 4-5).

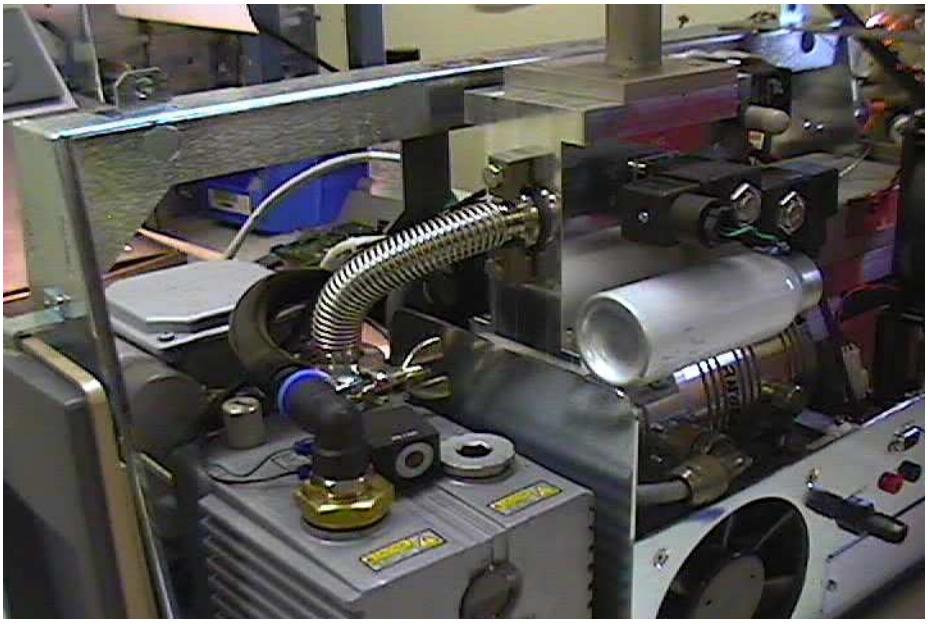

Figure 4-5 Vacuum Connection

3. Remove the ground to the valve block (CONDS) (Figure 4-6).

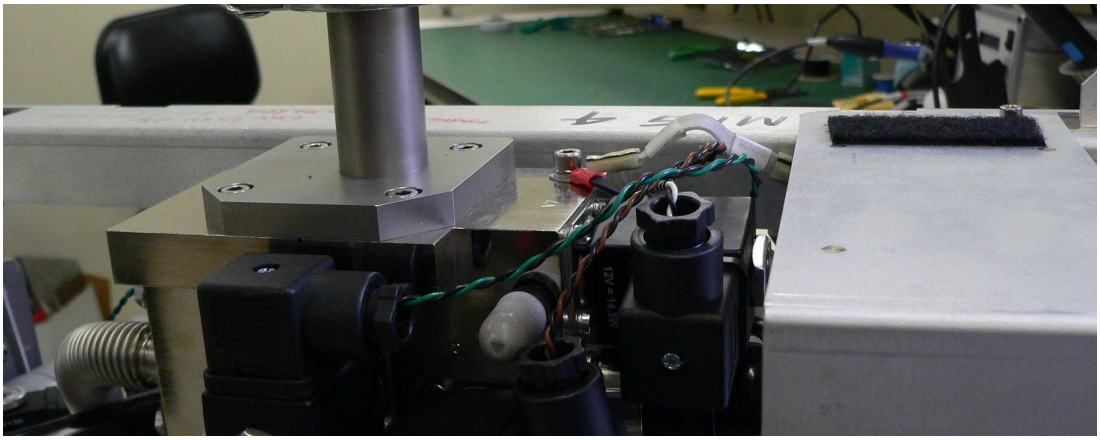

Figure 4-6 Valve Block Ground

4. Unscrew the Phillips screw for the spectrometer ground (SP_GND) (Figure 4-7).

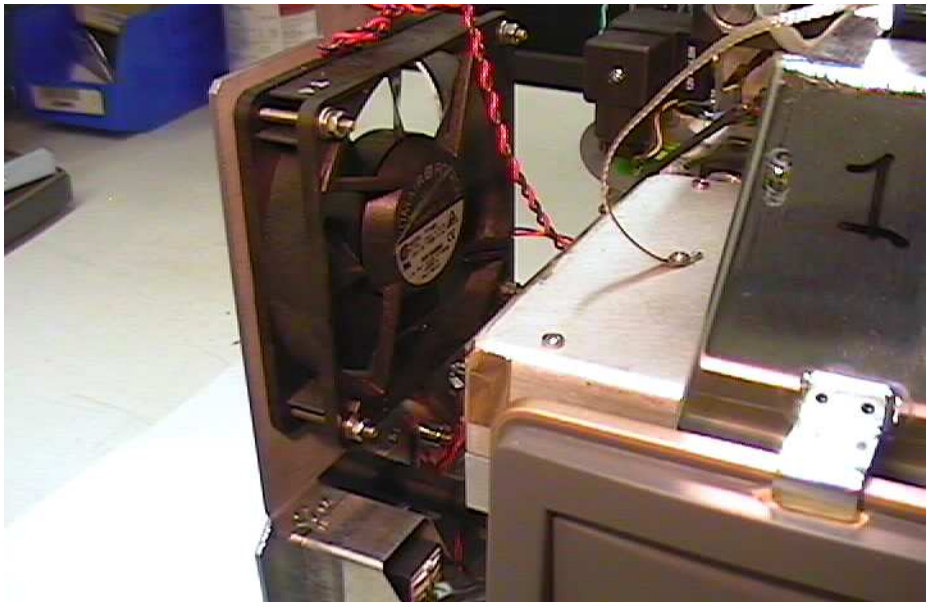

Figure 4-7 Spectrometer Ground Wire

5. Disconnect the (Figure 4-8):
   - ❑ Ion source sensor cable (R2126-301)
   - ❑ Pre-amp cable (R2125-301)

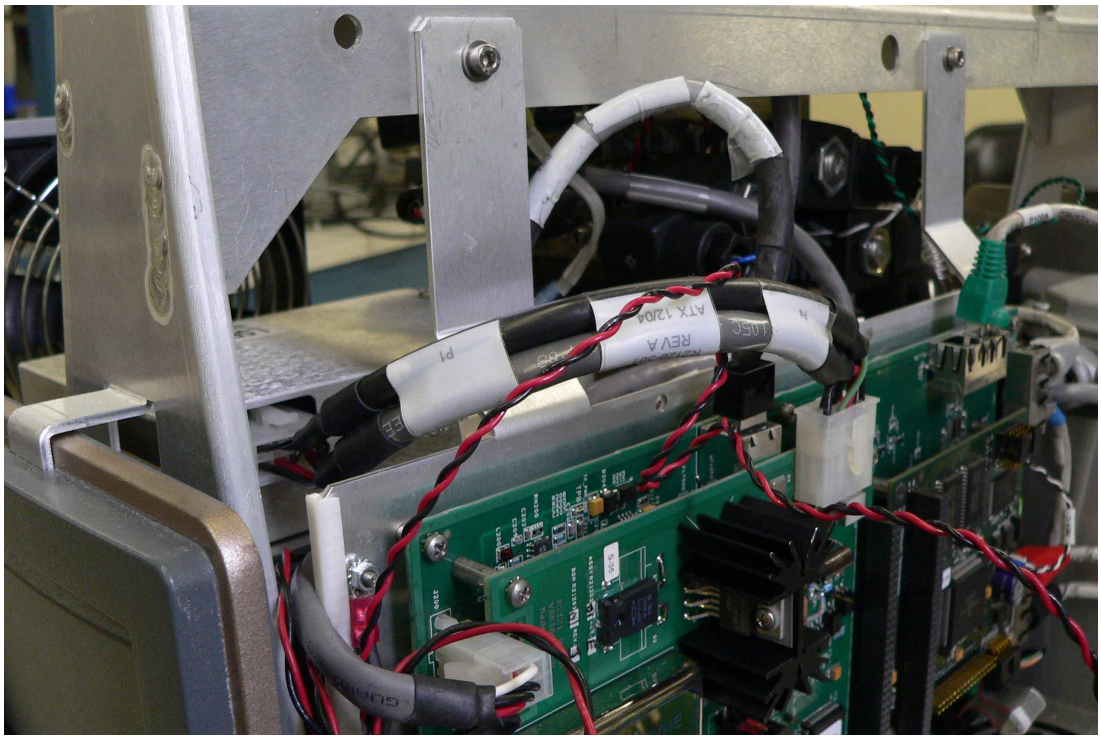

Figure 4-8 Leak Sensor and Pre-Amp Cables

6. Loosen and remove the two wing nuts holding the plastic shield and remove the shield (Figure 4-9).

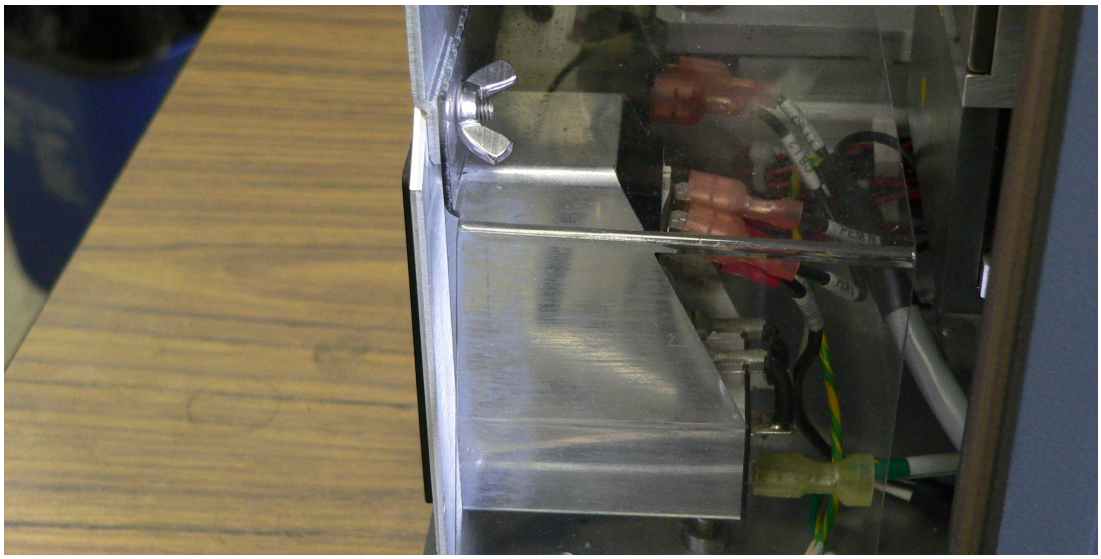

Figure 4-9 Plastic Shield

7. Loosen and remove the four M5 screws and rubber spacers holding the unit to the VS Series body (Figure 4-10). Two are shown with the unit already removed for a better view. The spectrometer and turbo pump are shown together.

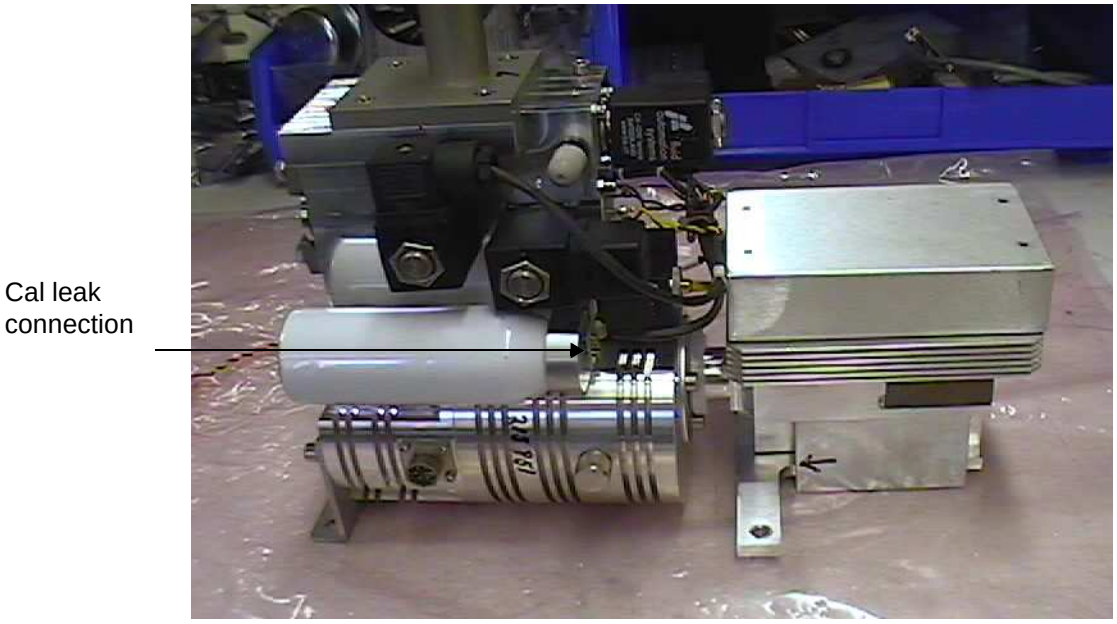

Figure 4-10 Valve Block Assembly and Spectrometer M5 Mounting Screws

8. Carefully disconnect the calibrated leak temperature cable from the calibrated leak PC board (Figure 4-11).

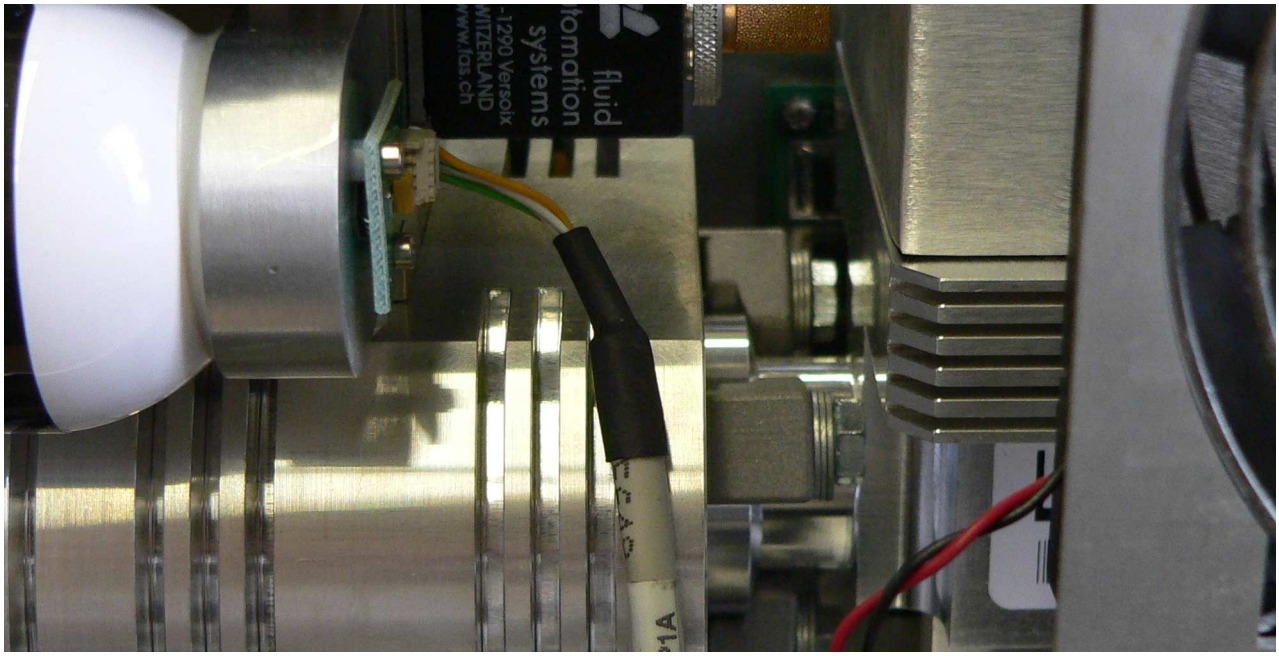

Figure 4-11 Calibrated Leak Connection

9. Loosen the four M3 screws and disconnect the turbo controller cable from the pump (Figure 4-12).

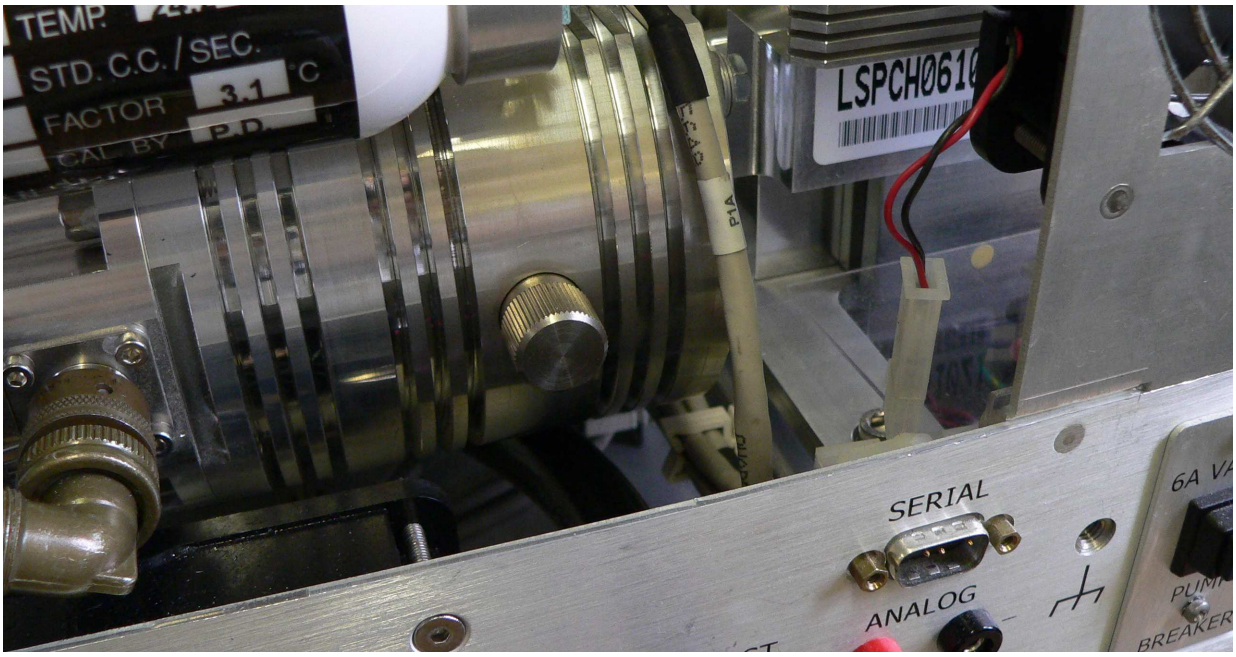

Figure 4-12 Turbo Controller Connection

10. Gently pull the valve block assembly straight up and out of the unit. Place the block bottom down on a flat surface (Figure 4-10 on page 4-7).
11. Remove the three bolts for the spectrometer connection. Take care not to damage the O-ring (Figure 4-13).

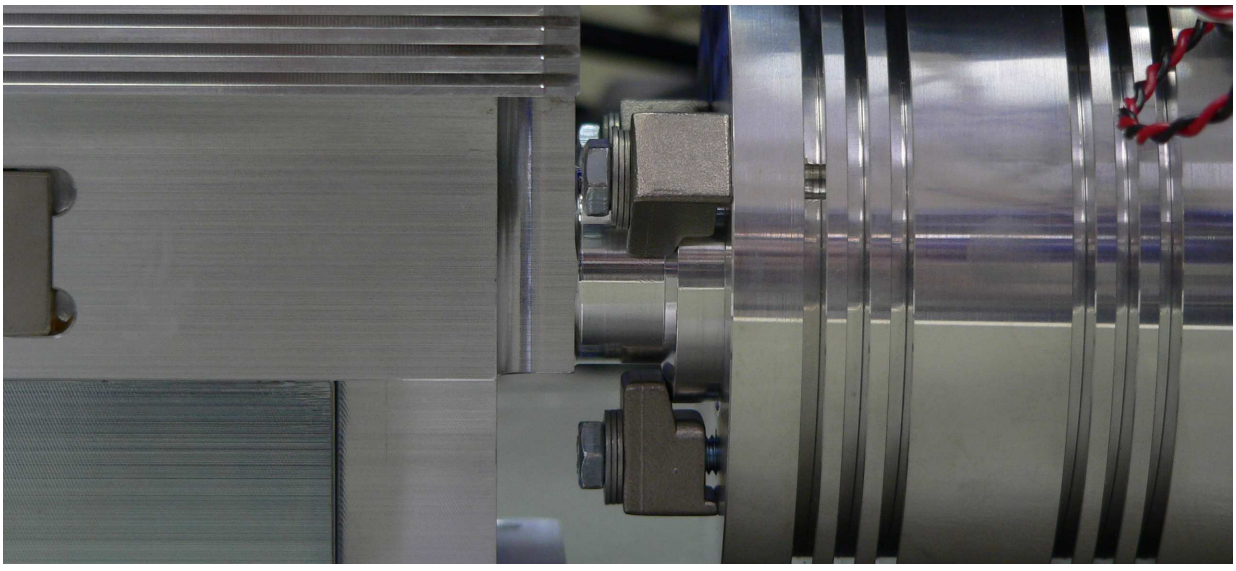

Figure 4-13 Spectrometer Nut Locations

12. Replace the spectrometer and reattached the pump as per step 11.

4.4 Replacing the Turbo Pump, Valve Block and Spectrometer

To reinstall the scroll pump and valve block:

1. Gently place the valve block onto it mounting holes and tighten the four M5 screws nuts (Figure 4-10 on page 4-7).
2. Reinstall the two bolts for the vacuum connection. Take care not to damage the O-ring (Figure 4-5 on page 4-4).
3. Tighten the Phillips head screw connecting the test port ground wire to the center rail (Figure 4-4 on page 4-4).
4. Reinstall the four M3 screws that connect the turbo controller cable to the pump (Figure 4-12 on page 4-8).
5. Reconnect the calibrated leak temperature cable from the calibrated leak PC board (Figure 4-11 on page 4-7).

4.5 Replacing the Valve Block Harness and Thermocouple Wiring

To replace the wiring:

1. Replug the valve plugs, screw the Phillips head screw and reattach the wires from the six three-prong blocks (Figure 4-2 on page 4-3).
2. Reattached the thermocouple wires (Figure 4-3 on page 4-3).
3. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 4-1 on page 4-2).
4. Replace and retighten the two wing nuts holding the plastic shield (Figure 4-9 on page 4-6).
5. Reconnect the ground connection on the valve block and the spectrometer (Figure 4-7 on page 4-5).
6. Tighten the Phillips head screw connecting the test port ground wire to the center rail (Figure 4-4 on page 4-4).
7. Reconnect the (Figure 4-8 on page 4-6):
   - ❑ Ion source sensor cable (R2126-301)
   - ❑ Pre-amp cable (R2125-301)
8. Reinstall the four screws holding the front plastic cover to attach the cover to the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 4-1).
9. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 4-1).

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Section 5. The Electronics

This chapter gives the replacement procedures for the VS Series electronics. Refer to Appendix D “Troubleshooting” for diagnostics to determine when to replace various boards and flow control modules. Refer to Appendix E “Interconnection Diagram” for a diagram showing the electronics interconnections.

5.5.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ M5 Allen Wrench
- ❑ Phillips Screw Driver
- ❑ Slotted Screw Driver

5.1 User Interface

To replace the user interface:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-1) and detach the rear plastic cover from the unit.
4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-1).

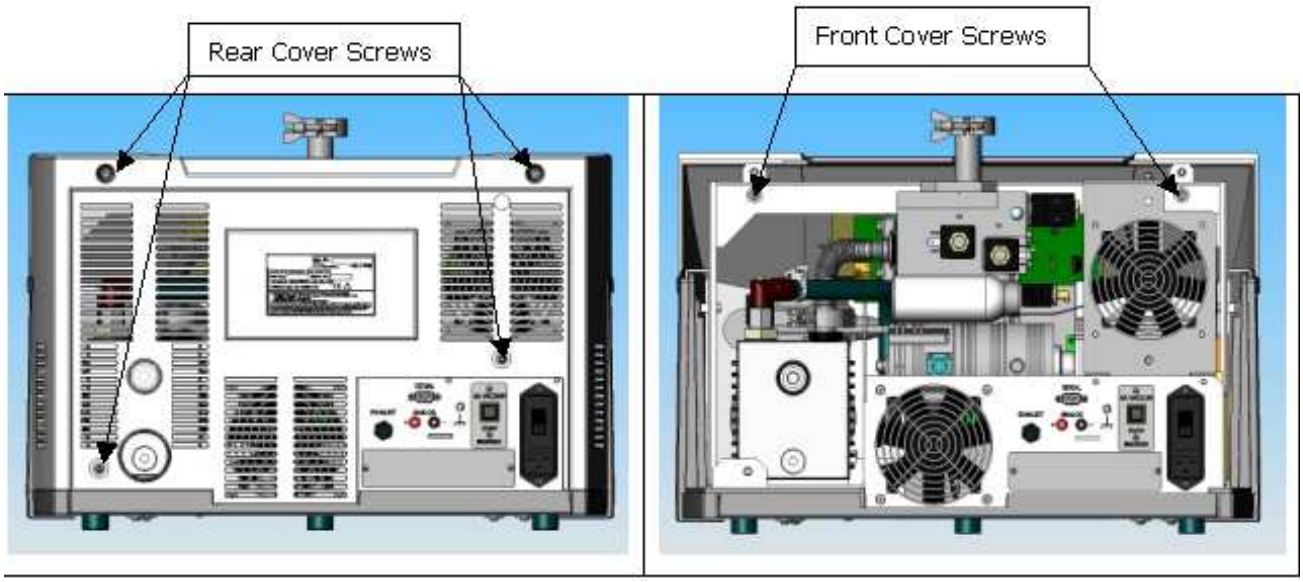

Figure 5-1 Rear and Front Cover Screws

5. Remove the user interface front cover using an Allen wrench to loosen the M4 screw at the bottom front of the plate (Figure 5-2).

Figure 5-2 User Interface Plate Mounting Screw

6. Gently rock the metal interface panel up and out.

7. Disconnect the speaker wire, green plug, ground and red/black wire connector at the interface board Figure 5-3.

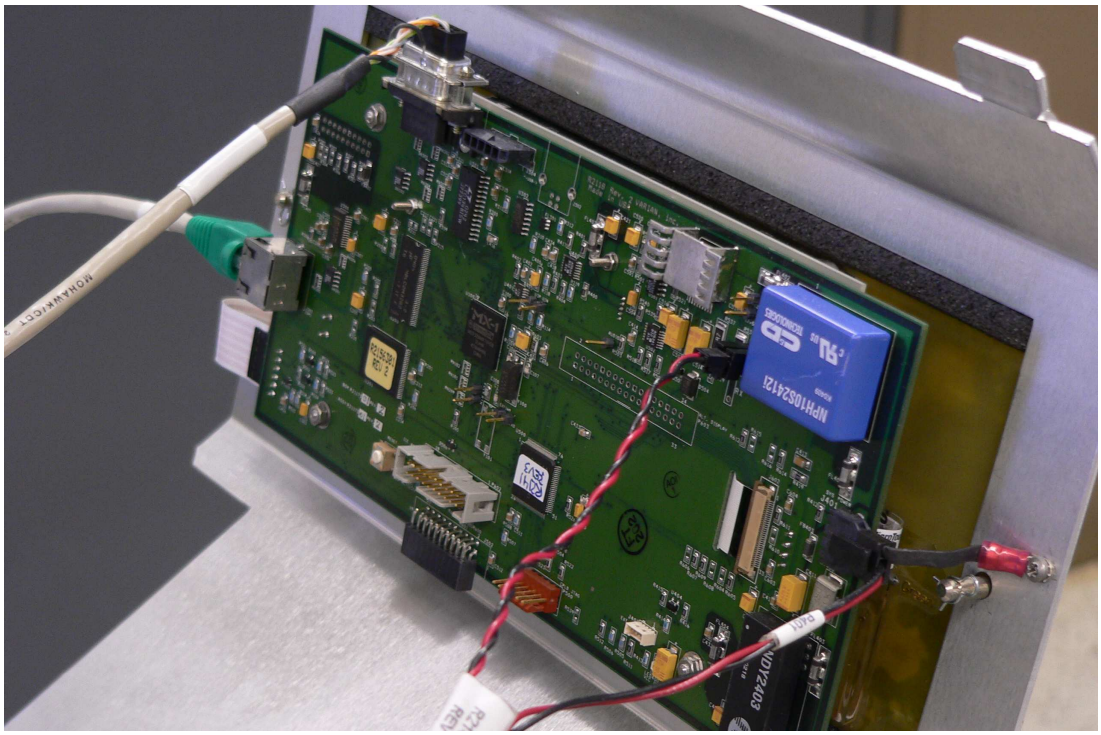

Figure 5-3 Interface Board Wiring

8. Use a nut driver to remove the four hex nuts that mount the interface board to the user interface (Figure 5-4). The spacers between the interface board and user interface loosen as well; remove them.

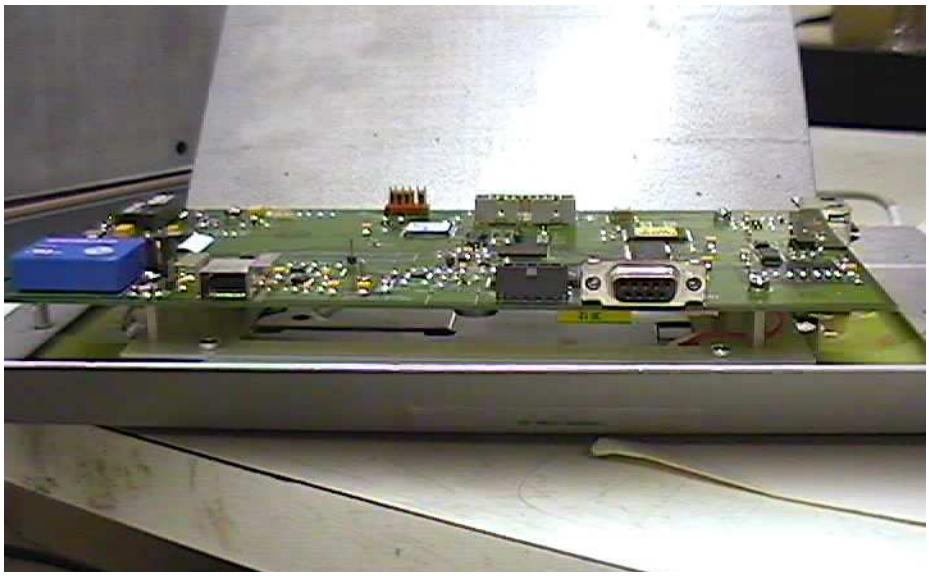

Figure 5-4 Interface Board Mounting Nuts

9. Disconnect the two ribbon cables on the left and right sides of the board and gently lift board off (Figure 5-5).

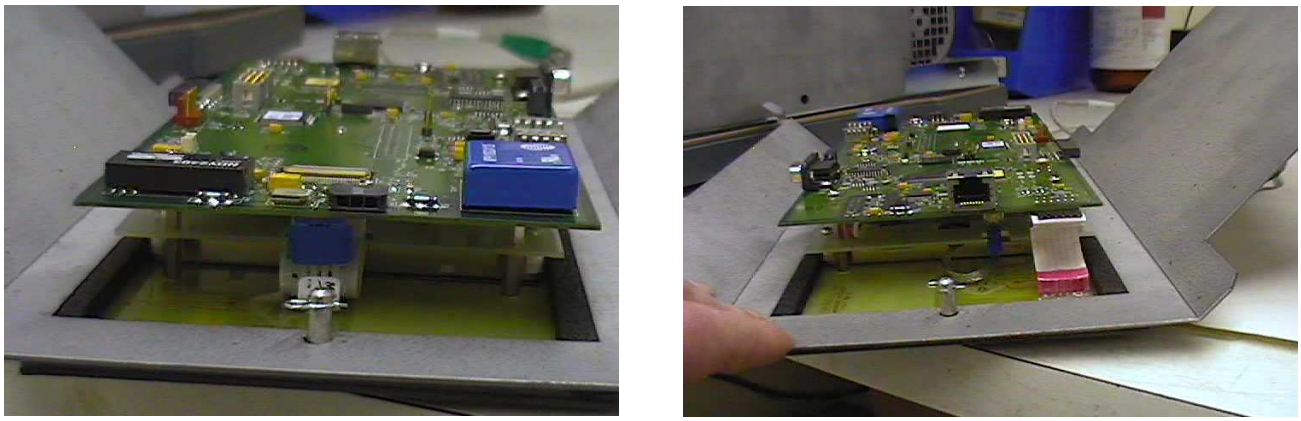

Figure 5-5 User Interface Board to Front Panel Display Wiring

10. Gently pull the board out and disconnect the blue plug from the user interface board that originates on the display (Figure 5-6).
11. Disconnect the white plug form the backside of the interface board (Figure 5-6).

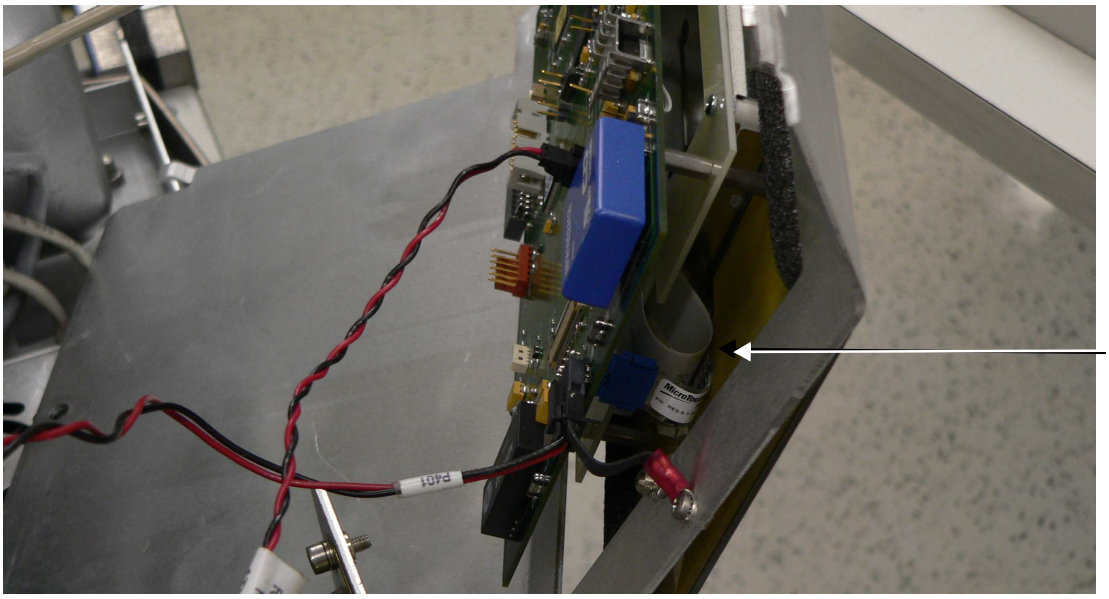

Figure 5-6 White Plug to Front Panel

12. Disconnect the green/yellow wire spade connection that runs between the user interface board and the Front Panel (Figure 5-7).

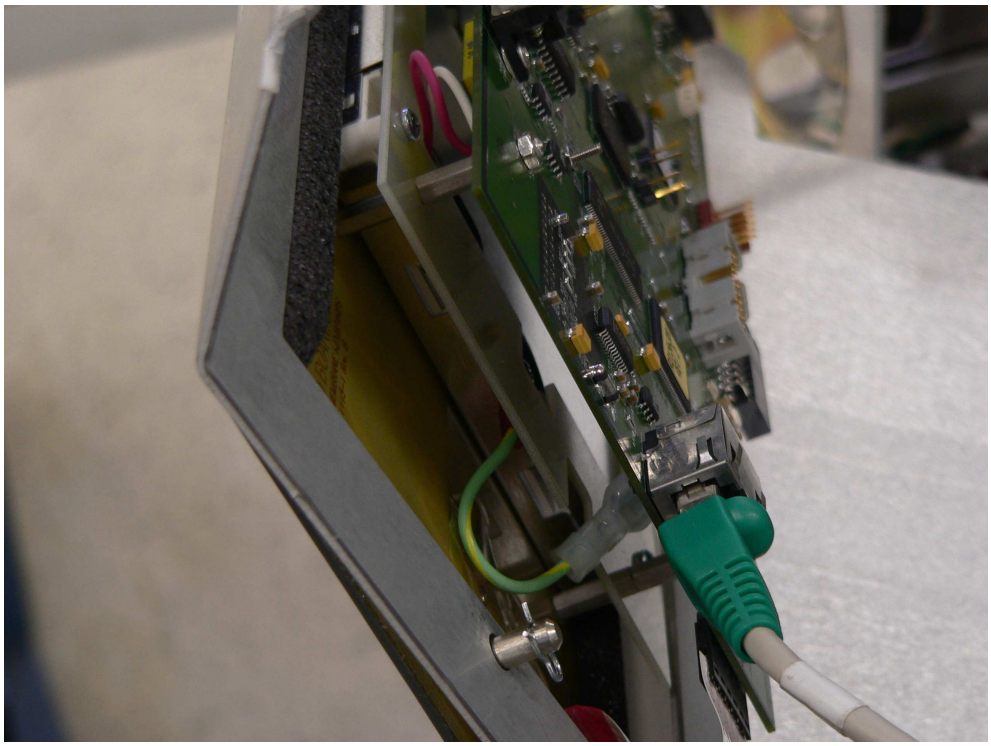

Figure 5-7 Green/Yellow Wire to Front Panel

13. Remove the four Phillips head screws that hold the user interface in place. The spacers between the interface and the front membrane loosen as well; remove them.
14. Place the new interface into the slot, inserting the spacers and reinstall the four Phillips head screws.
15. Inert the spacers between the user interface and the user interface board and gently place the user interface on top.
16. Replace and tighten the four hex nuts that mount the interface board to the user interface (Figure 5-4).
17. Reconnect the green/yellow wire spade connection that runs between the user interface board and the Front Panel (Figure 5-7).

18. Reconnect the blue plug from the user interface board that originates on the display (Figure 5-8).

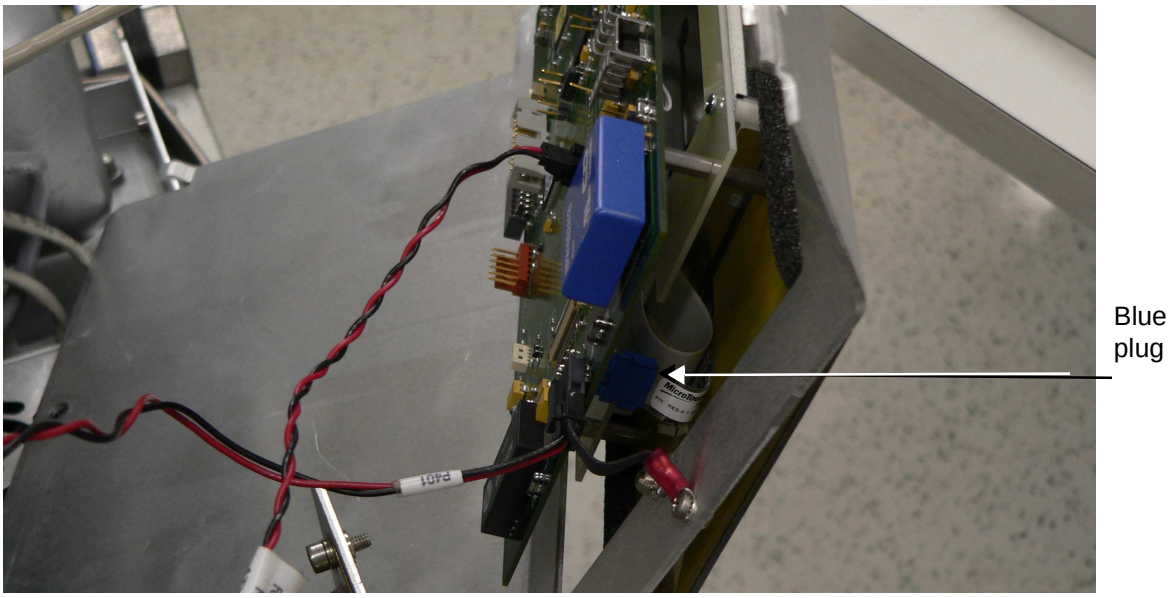

Figure 5-8 White Plug to Front Panel

19. Reconnect the white plug form the backside of the interface board (Figure 5-6 on page 5-4).
20. Reconnect the two ribbon cables on the left and right sides of the board (Figure 5-5 on page 5-4).
21. Use a nut driver to reinstall the four hex nuts and the spacers that mount the interface board to the user interface (Figure 5-4).
22. Reconnect the speaker wire, green plug, ground and red/black wire connector at the interface board Figure 5-3.
23. Gently rock the metal interface panel back in place.
24. Reattach the user interface front cover using an Allen wrench to tighten the M4 screw and washer at the bottom front of the plate (Figure 5-2).
25. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-1).
26. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-1).

5.2 CPU Board

To replace this board:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-9) and detach the rear plastic cover from the unit.

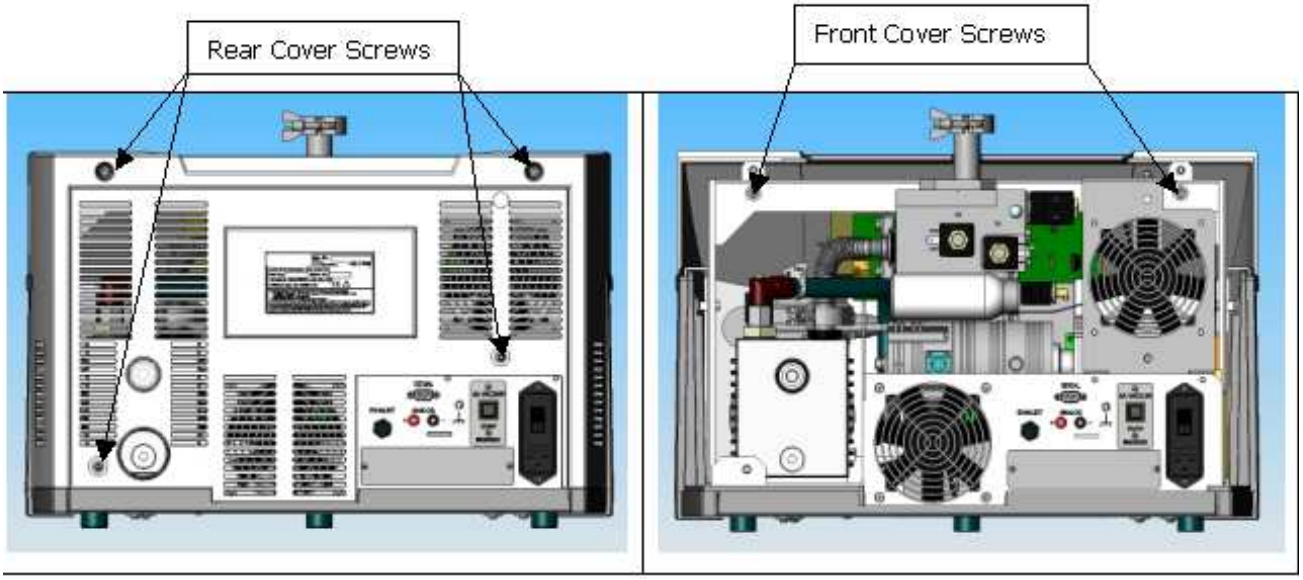

Figure 5-9 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-9).
5. Disconnect the:
   - ❑ R2140-301 from R24202 (black/white)
   - ❑ Grey plug rightside - R2730-301

6. Unscrew the four Phillips head screws (Figure 5-10). The spacers between the board and the mother board loosen as well; remove them.

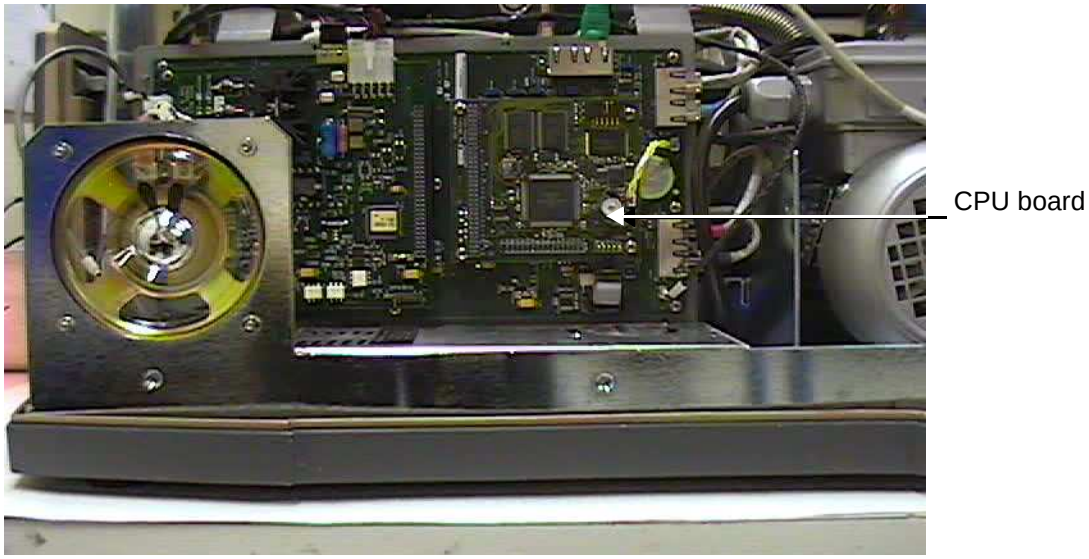

Figure 5-10 Mounting Screws

7. Remove the board.
8. Place the new board with the spacers into the location.
9. Replace and tighten the four Phillips head screws and spacers on the corners of the board (Figure 5-10).
10. Reconnect the:
    - ❑ R2140-301 from R24202 (black/white)
    - ❑ Grey plug rightside - R2730-301
11. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-9 on page 5-7).
12. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-9 on page 5-7).

5.3 Ion Source Board

To replace this board:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-11) and detach the rear plastic cover from the unit.

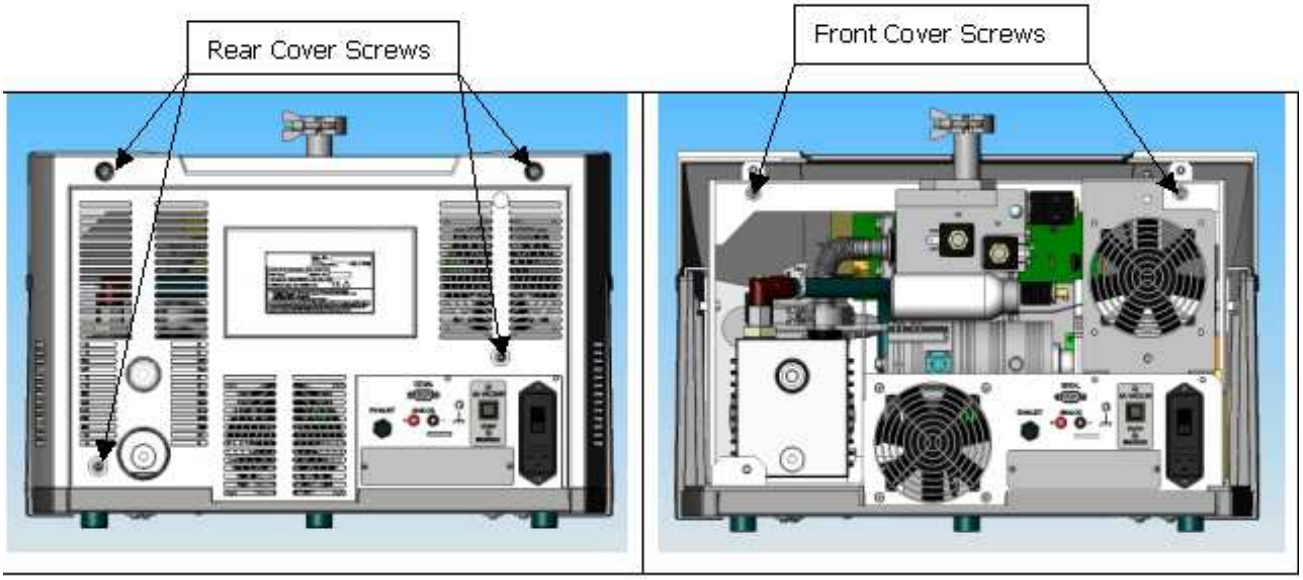

Figure 5-11 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-11).
5. Disconnect the:
   - ❑ P1 cable
   - ❑ P1 - J1 cable from position J1 and unscrew the red/black ground from the lower left

6. Unscrew the four Phillips screws (Figure 5-12). The spacers between the board and the mother board loosen as well; remove them.

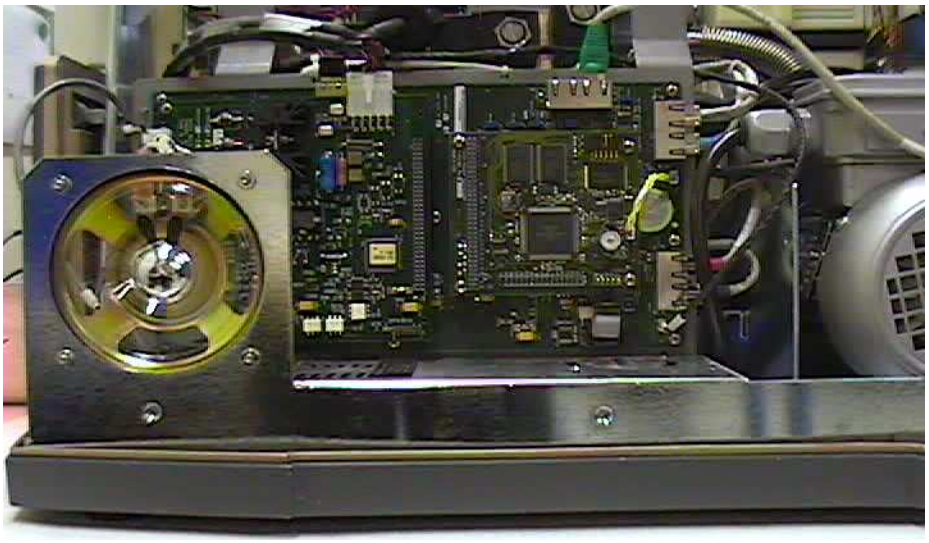

Figure 5-12 Mounting Screws

7. Remove the board.
8. Place the new board with the spacers into the location.
9. Replace and tighten the four Phillips head screws and spacers on the corners of the board (Figure 5-10).
10. Reconnect the:
    - ❑ P1 cable
    - ❑ P1 - J1 cable from position J1 and unscrew the red/black ground from the lower left
11. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-11).
12. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-11).

5.4 Mother Board

To replace this board:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-11) and detach the rear plastic cover from the unit.

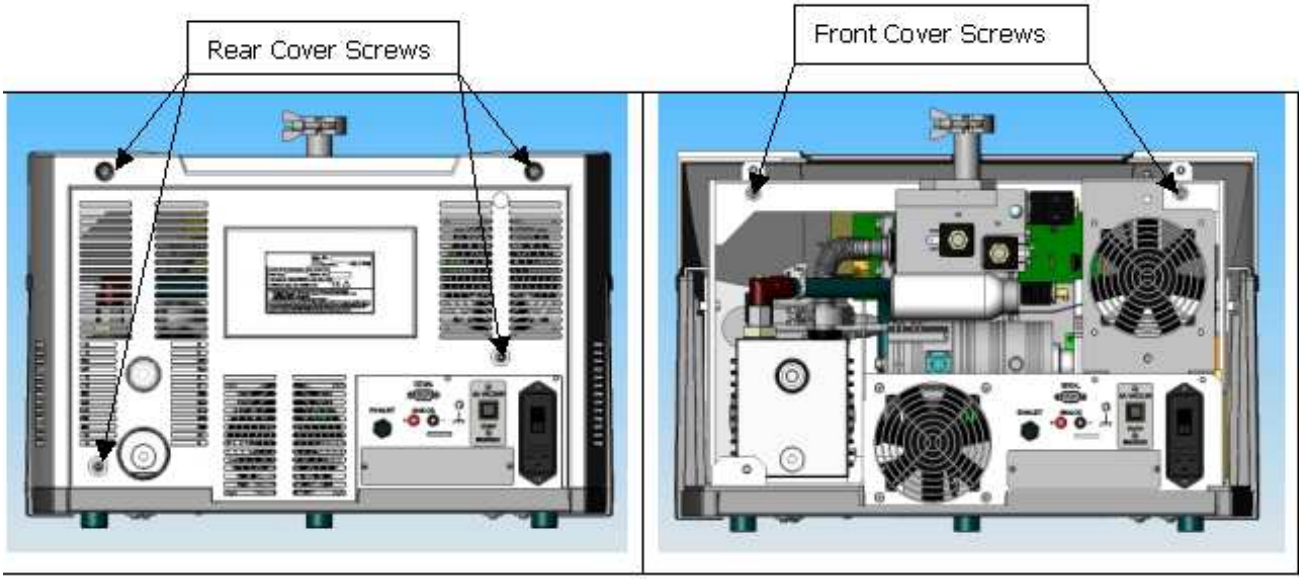

Figure 5-13 Rear and Front Cover Screws

4. Remove the right board as per Section 5.2 “CPU Board” on page 5-7.
5. Remove the left board as per Section 5.3 “Ion Source Board” on page 5-9.

6. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-14).

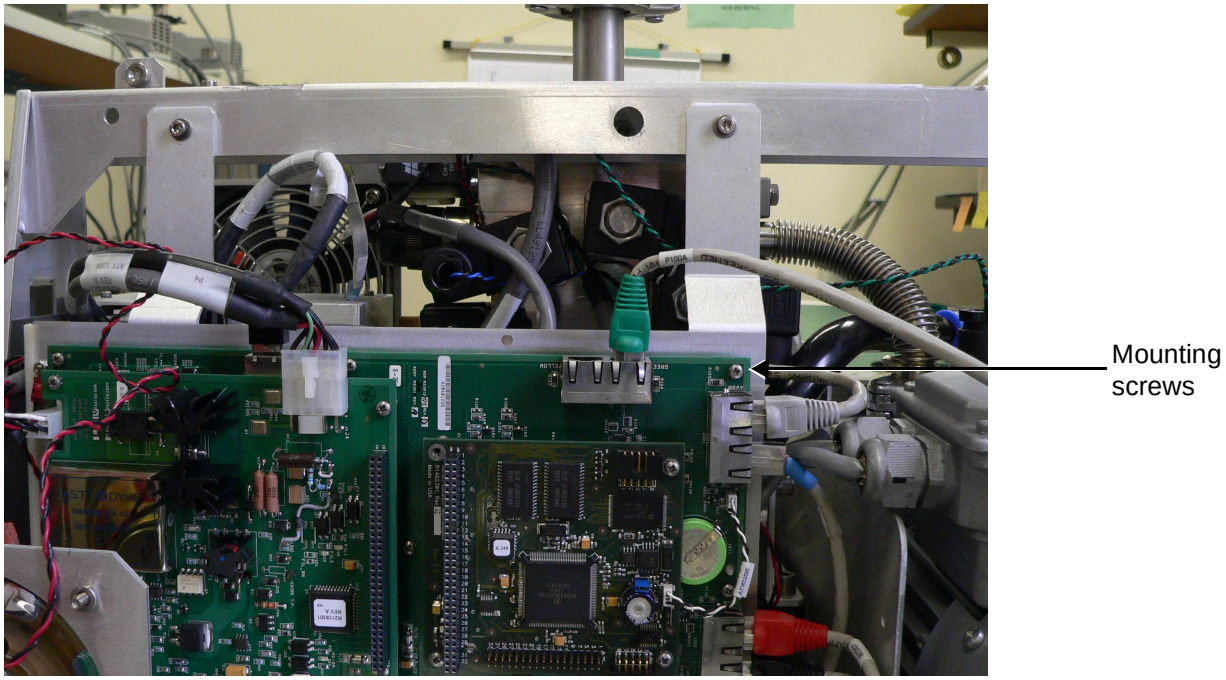

Figure 5-14 Motherboard Screw Locations

7. Disconnect the:
   - ❑ Top board:
     - ❑ Green plug (P100A) at J100 on the right
     - ❑ Yellow plug (P100B) at J100 on the left
   - ❑ Righhand board:
     - ❑ Blue plug (P101A) at J100 on the bottom
     - ❑ Grey plug (P101B) at J100 on the top
   - ❑ Righthand bottom board:
     - ❑ Red plug (P101A) at J302 on the top
     - ❑ Black plug (P101B) at J302 on the bottom
   - ❑ R2142-301 at J300 (black/white) - connection to right board
   - ❑ White plug at J301 (green/white/yellow)
   - ❑ White plug (P200) at J200 (white/black/red) and ground to back plate
   - ❑ Black plug (P500) at J500
8. Remove the board.

9. Place the new board with the spacers into the location.
10. Replace and tighten the four Phillips head screws and spacers on the corners of the board (Figure 5-14 on page 5-12).
11. Reconnect the:
    - ❑ Top board:
      - ❑ Green plug (P100A) at J100 on the right
      - ❑ Yellow plug (P100B) at J100 on the left
    - ❑ Righhand board:
      - ❑ Blue plug (P101A) at J100 on the bottom
      - ❑ Grey plug (P101B) at J100 on the top
    - ❑ Righthand bottom board:
      - ❑ Red plug (P101A) at J302 on the top
      - ❑ Black plug (P101B) at J302 on the bottom
    - ❑ R2142-301 at J300 (black/white) - connection to right board
    - ❑ White plug at J301 (green/white/yellow)
    - ❑ White plug (P200) at J200 (white/black/red) and ground to back plate
    - ❑ Black plug (P500) at J500
12. Reinstall the right board as per Section 5.2 “CPU Board” on page 5-7.
13. Reinstall the left board as per Section 5.3 “Ion Source Board” on page 5-9.
14. Replace the user interface front cover using an Allen wrench to tighten the M4 screw and washer at the bottom front of the plate (Figure 5-2 on page 5-2).
15. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-11 on page 5-9).
16. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-11 on page 5-9).

5.5 Valve Driver Board

To replace this board:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-15) and detach the rear plastic cover from the unit.

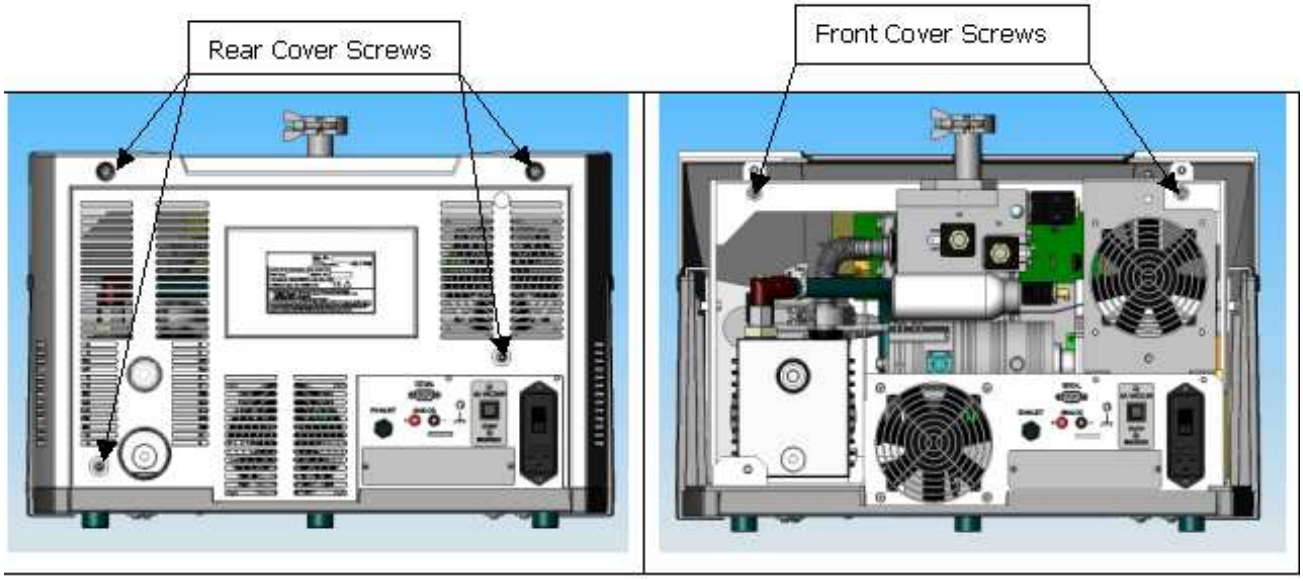

Figure 5-15 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-15).
5. Loosen and remove the two M4 screws and washers that hold the electronics back plate to the top rail (Figure 5-16) and gently rock the assembly forward.

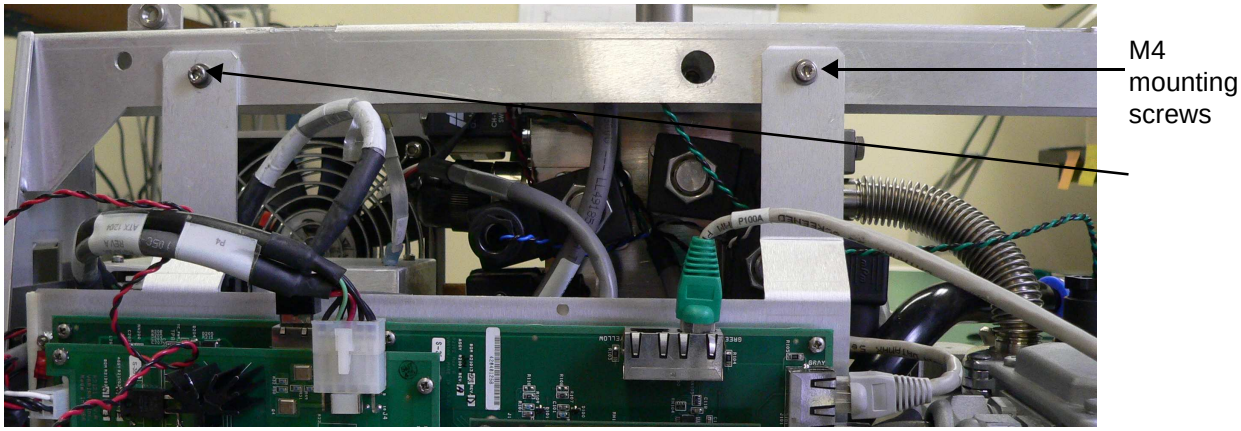

Figure 5-16 M4 Mounting Screws

6. Unscrew the four Phillips screws. The spacers between the board and the backplate loosen as well; remove them (Figure 5-17).

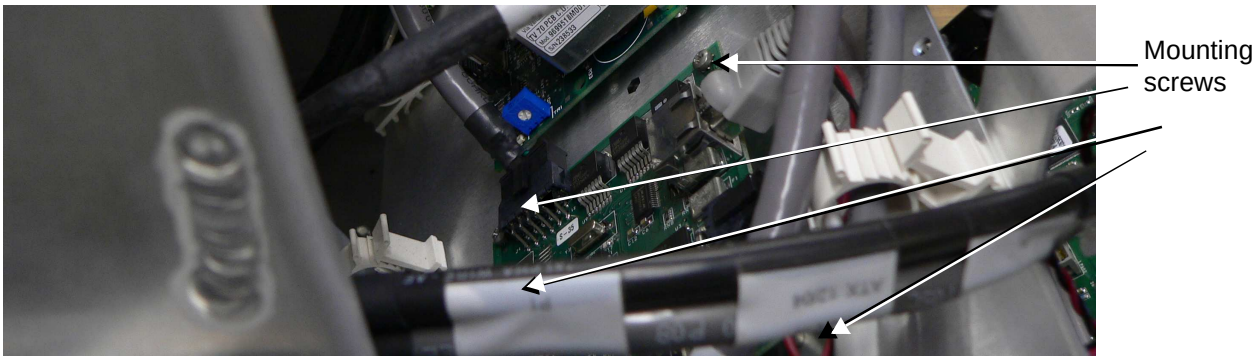

Figure 5-17 Valve Driver Board Mounting Screws

7. Disconnect the:
   - ❑ 24 VDC connector at J2 (R2124301)
   - ❑ Valve driver cables (2) at J3 and J4 (R2431301 and R2432301)
   - ❑ Gray RS-232 cable (R2130301)

NOTE

Take care with cable bundle on the back of the board. The white clip opens so the cable can be temporarily moved to access the board.

8. Remove the board.
9. Place the new board with the spacers into the location.
10. Replace and tighten the four Phillips head screws and spacers on the corners of the board.
11. Reconnect the:
    - ❑ 24 VDC connector at J2 (R2124301)
    - ❑ Valve driver cables (2) at J3 and J4 (R2431301 and R2432301)
    - ❑ Gray RS-232 cable (R2130301)
12. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-11).
13. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-11).

5.6 Turbo Controller Board

To replace this board:

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 5-18) and detach the rear plastic cover from the unit.

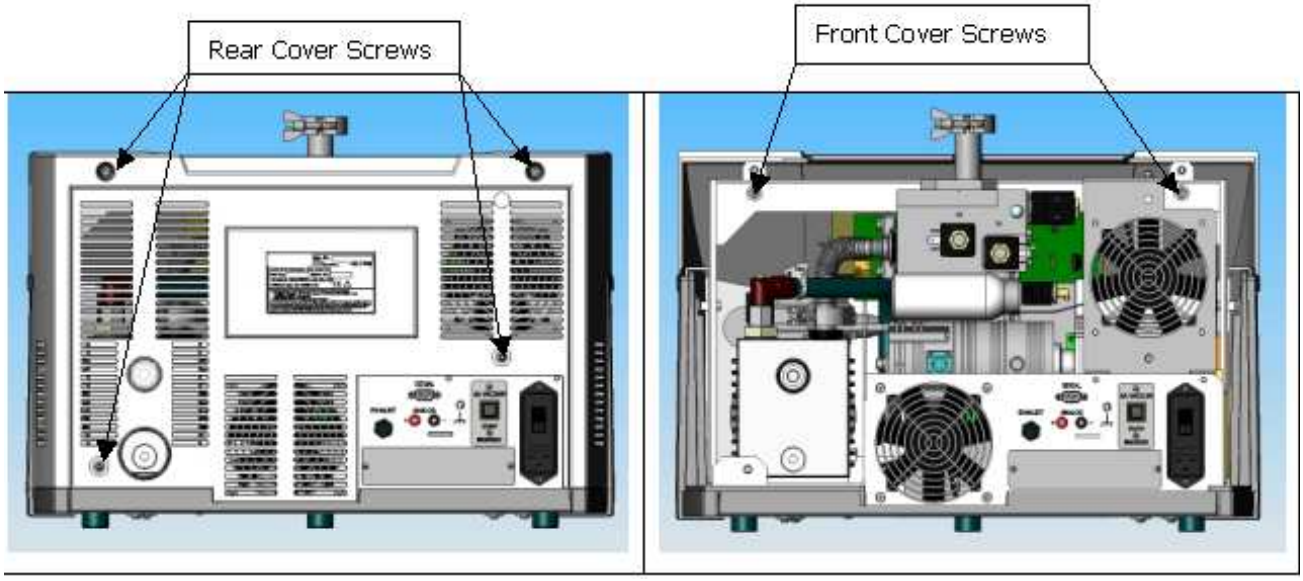

Figure 5-18 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-18).
5. Loosen and remove the two M4 screws and washers that hold the electronics back plate to the top rail (Figure 5-19) and gently rock the assembly forward.

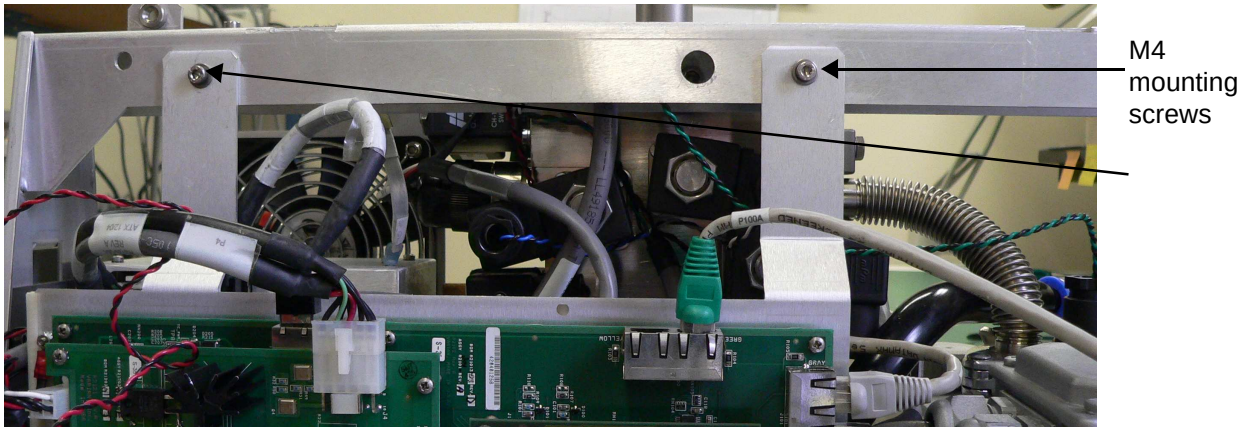

Figure 5-19 M4 Mounting Screws

6. Unscrew the four Phillips screws. The spacers between the board and the backplate loosen as well; remove them (Figure 5-20).

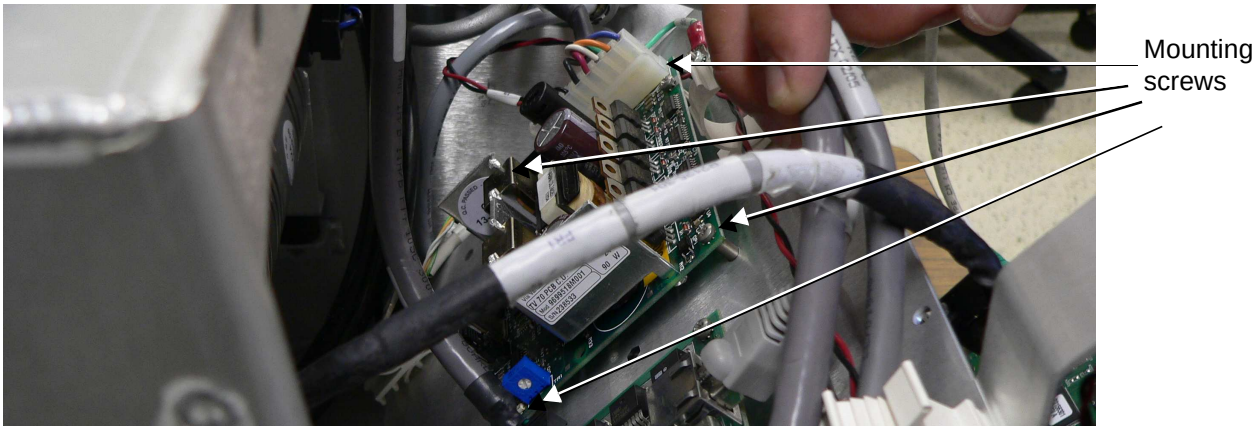

Figure 5-20 Turbo Controller Board Mounting Screws

7. Disconnect the:
   - ❑ 24 VDC J3 connector (R2124301)
   - ❑ Turbo controller cable (R134301)
   - ❑ RS-232 cable (R2133301)
   - ❑ Ground at the top the backplate

NOTE

Take care with cable bundle on the back of the board. The white clip open so the cable can be temporarily moved to access the board.

8. Remove the board.
9. Place the new board with the spacers into the location.
10. Replace and tighten the four Phillips head screws and spacers on the corners of the board.
11. Reconnect the:
    - ❑ 24 VDC J3 connector (R2124301)
    - ❑ Turbo controller cable (R134301)
    - ❑ RS-232 cable (R2133301)
    - ❑ Ground at the top the backplate
12. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 5-18 on page 5-16).
13. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 5-18 on page 5-16).

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Section 6. Turbo Molecular Pump and Roughing/Foreline Pumps

The VS Series has an internal high speed turbo pump and, depending upon your system's configuration, either one or three roughing/foreline pumps.

NOTE

The DS302 (MR15), TS620 (MD30) and the DS42 (PR02).

6.6.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ M5 Allen Wrench
- ❑ Phillips Screw Driver
- ❑ Slotted Screw Driver

6.1 DS-42 Fore Pump

CAUTION

The fore pump operates at high temperatures. Allow the pump to cool before proceeding.

To replace the fore pump:

1. Shut down the system using the On/Off rocker switch.
2. Wait for the pump to cool.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 6-1) and detach the rear plastic cover from the unit.

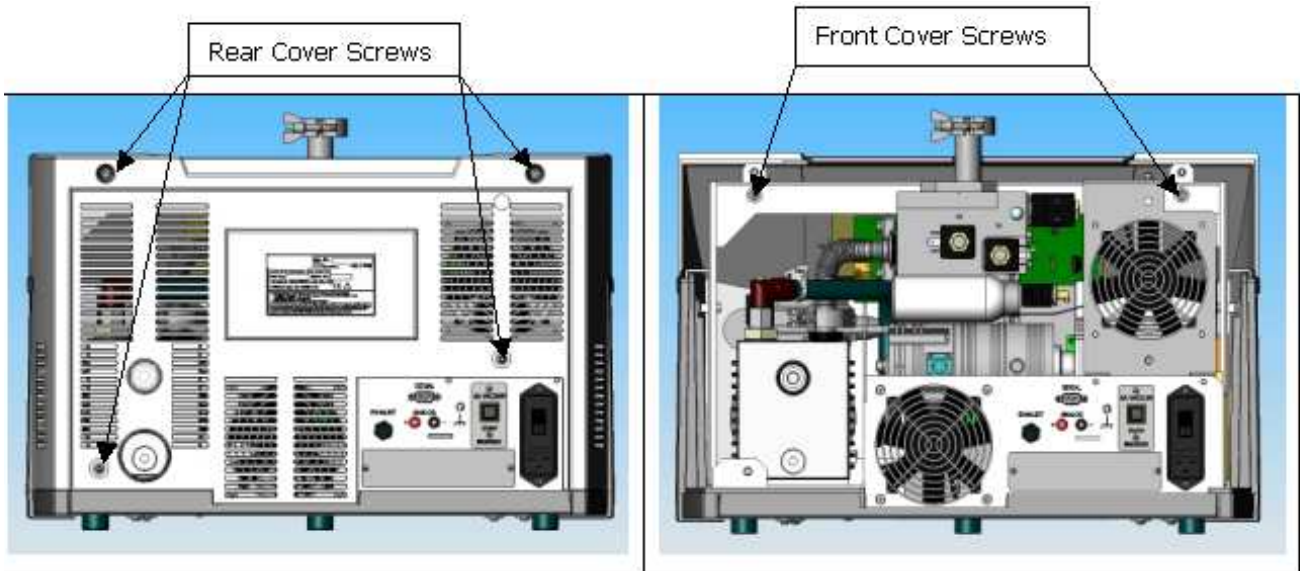

Figure 6-1 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 6-1).
5. Drain oil.
6. Unscrew the wing nut on the NW-16 clamp and remove the vacuum connection to the valve block (Figure 6-2).
7. Remove the sensor (Figure 6-2) to the VS Series housing by:
   a. Loosening the knurl nut on the top of the sensor form which the green/black wire exits and pulling off the cap.
   b. Removing the hex nut.

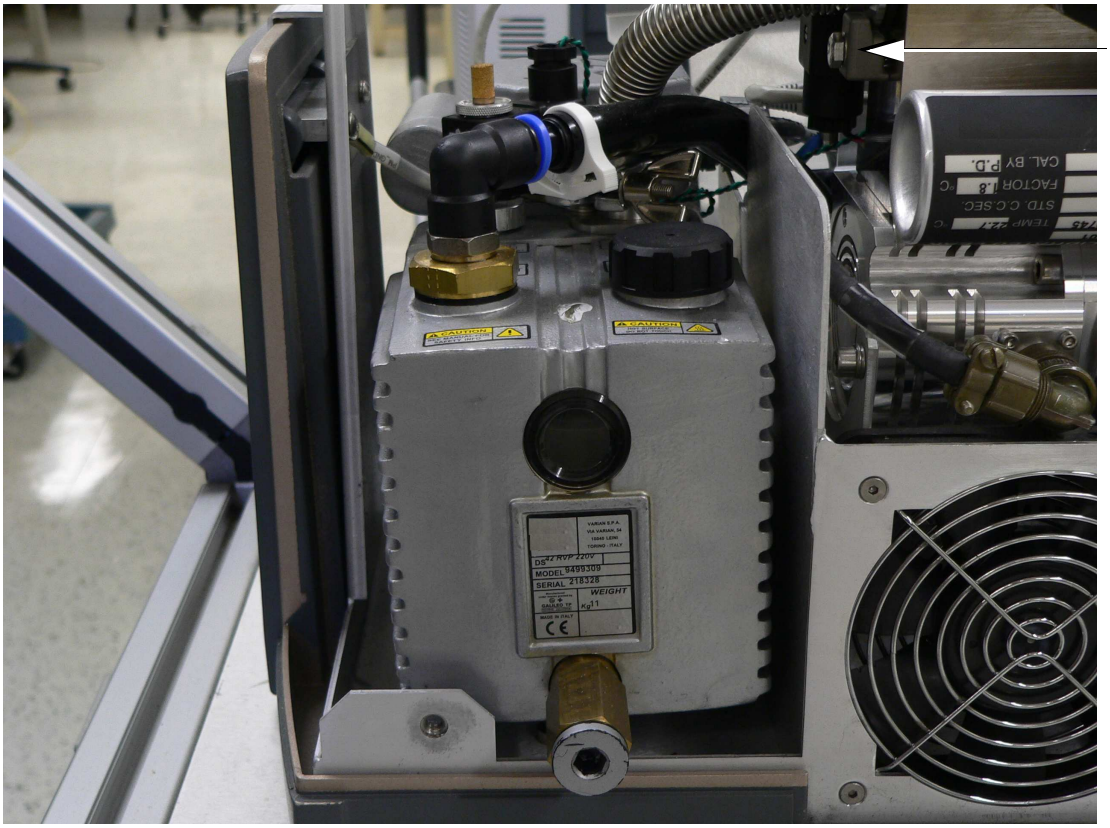

Figure 6-2 Valve Block Connection

8. Gently push the vacuum hose to the side (Figure 6-2).
9. Loosen the hex nut and remove the exhaust connection (Figure 6-2).

10. Remove the four Phillips screw on the cap and pull off the cap. (Figure 6-3).

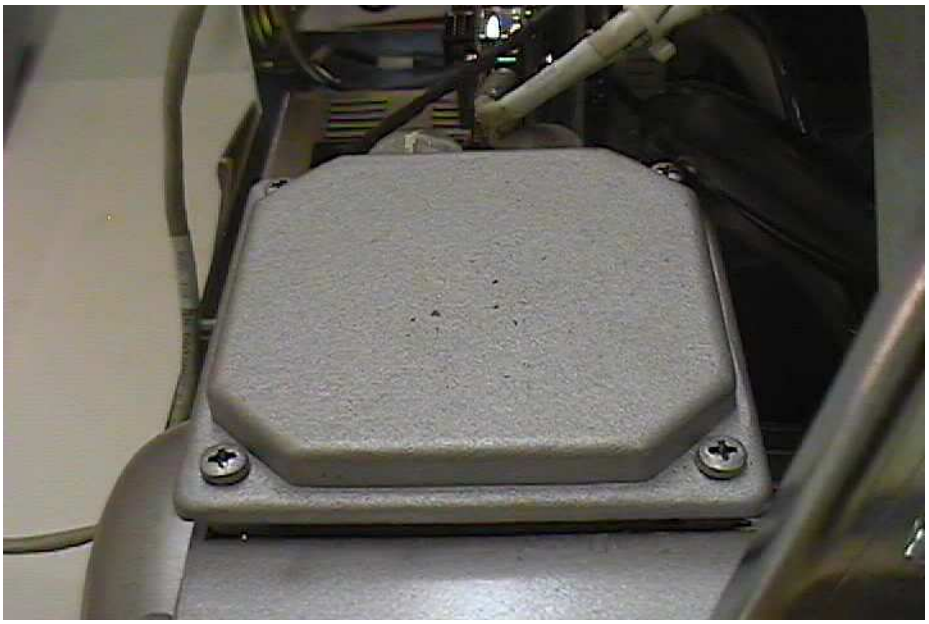

Figure 6-3 Fore Pump Cap

11. Loosen the two collars on the nuts exterior to the box and disconnect the wires inside and label them for reconnection (Figure 6-4).

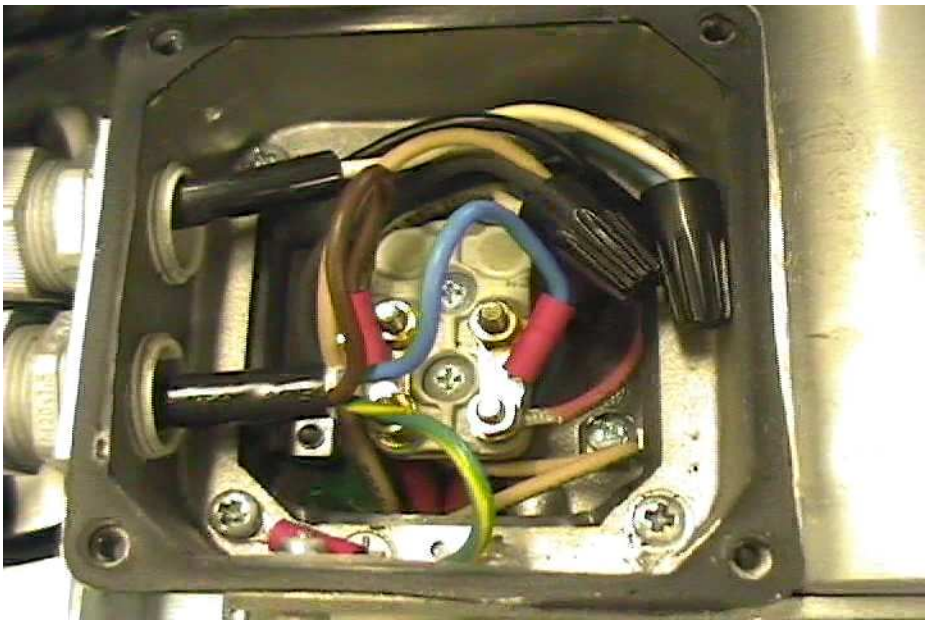

Figure 6-4 Cap Wire Connections

WARNING *Use two people for the next step.*

12. Place 6″ blocks under all four corners of the unit.
13. Rock the unit back gently.
14. Accessing from the bottom, remove the four Phillips head screws. (Figure 6-5).

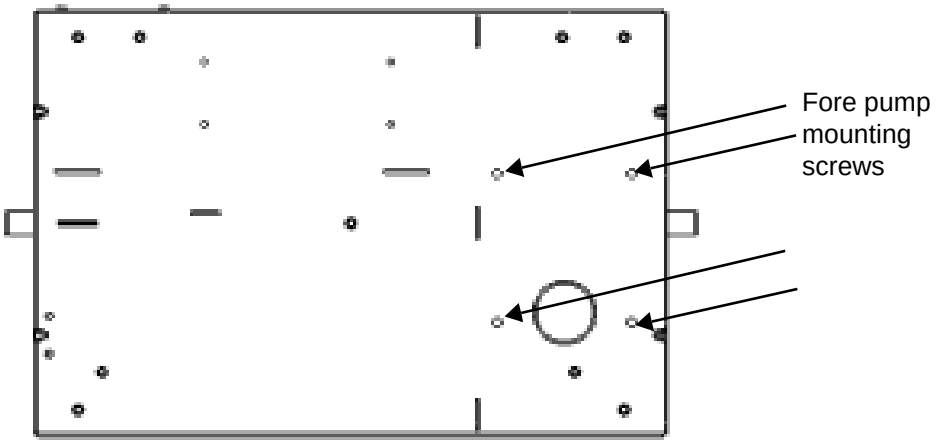

Figure 6-5 Fore Pump Mounting Screws

15. Remove the rubber spacers, washers and nuts (Figure 6-6).

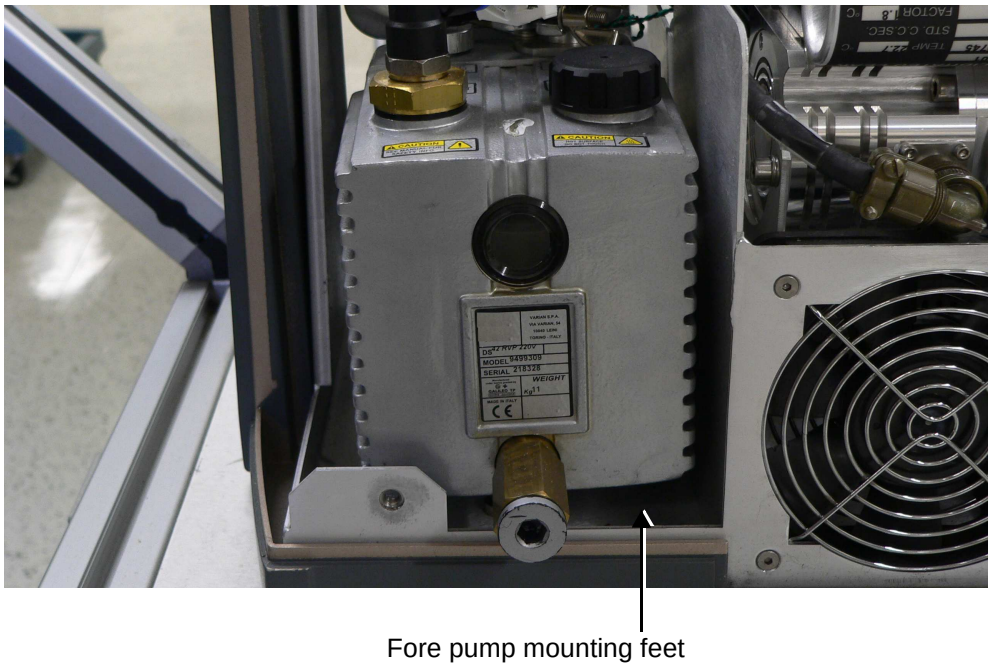

Figure 6-6 Fore Pump Mounting Spacers

16. Place the new pump in and screw down the spacers, washers and nuts.

WARNING *Use two people for the next step.*

17. Remove the 6" blocks under all four corners of the unit.
18. Reinstall the exhaust hose and tighten the hex nut (Figure 6-2).
19. Reinstall the valve block connection using the NW-16 wing nut (Figure 6-2).
20. Reconnect the wires in the box and tighten the two collars on the nuts exterior to the box (Figure 6-4).
21. Reinstall the four Phillips screw on the cap and pull off the cap. (Figure 6-3).
22. Replace the oil.
23. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 6-1).
24. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 6-1).

6.2 Scroll Pump

Replacing the scroll pump is comprised of:

1. Section 6.2.2 "Valve Block Wiring Harness"
2. Section 6.2.3 "Removing the Valve Block Assembly and Spectrometer" on page 6-8
3. Section 6.2.4 "Replacing the Turbo Pump, Valve Block and Spectrometer" on page 6-11
4. Section 6.2.5 "Replacing the Valve Block Harness and Thermocouple Wiring" on page 6-11

6.2.2 Valve Block Wiring Harness

The valve block wiring harness is comprised of seven three-prong sensor blocks labeled: V1 through V5 and V7 and the thermocouple. See the wiring diagram on Appendix E "Interconnection Diagram".

To remove the valve block wiring harness:

1. Shut down the system using the On/Off rocker switch.
2. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 6-1) and detach the rear plastic cover from the unit.

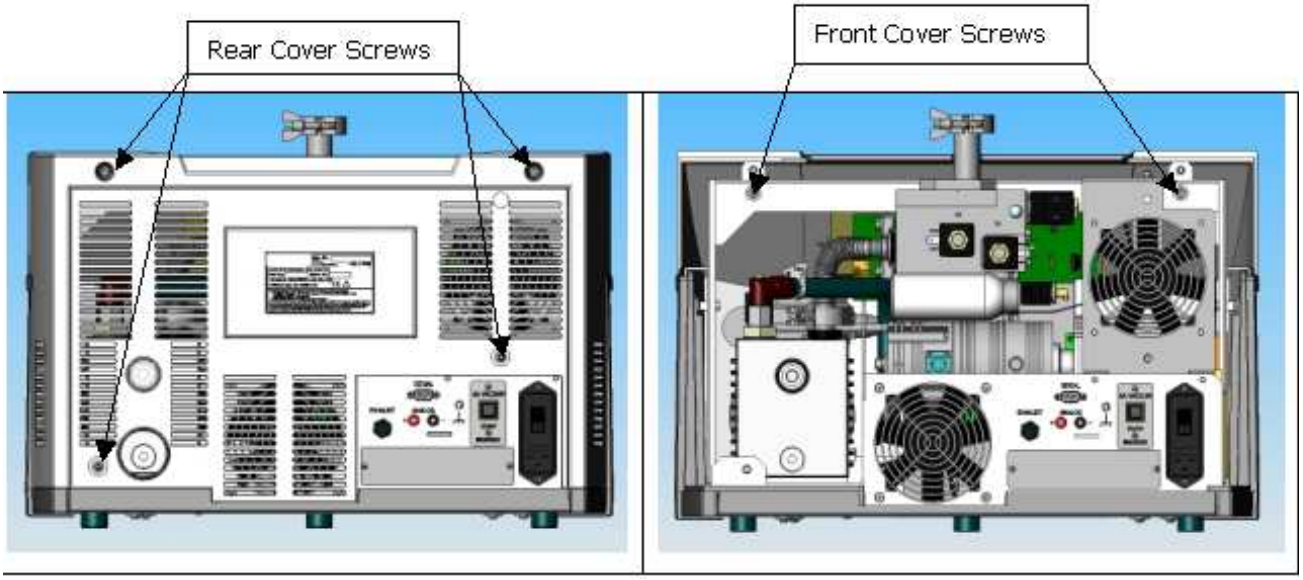

Figure 6-7 Rear and Front Cover Screws

3. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 6-1).
4. Disconnect valve block harness from the valve driver board. Connections are labeled *P3* and *P4*. Or, remove the valve plug or connector, unscrew the Phillips head screw and remove the wires from the six three-prong connector (Figure 6-8).

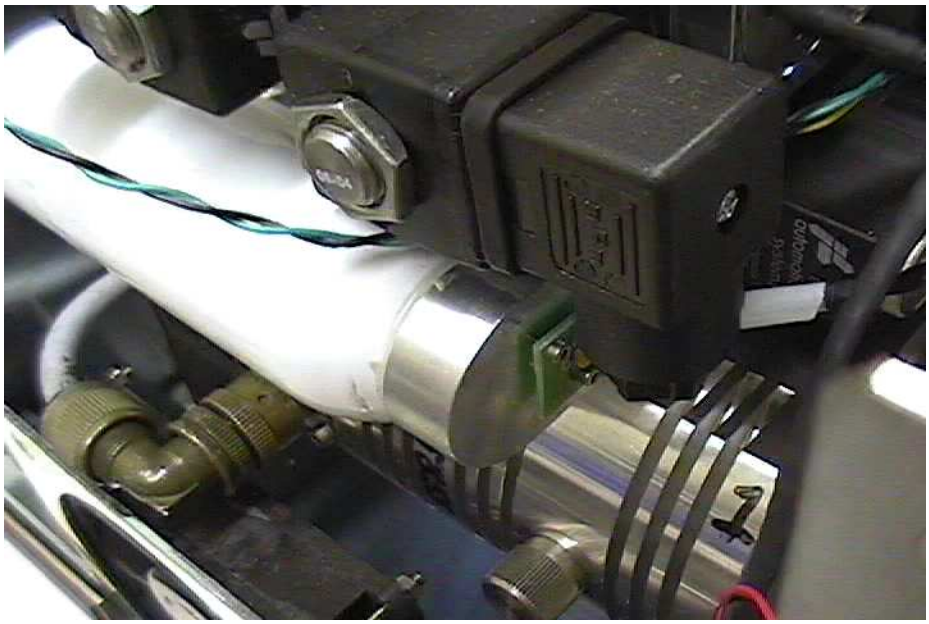

Figure 6-8 Sensor Wiring and Thermocouple

5. Unplug the thermocouple octal connector (Figure 6-9).

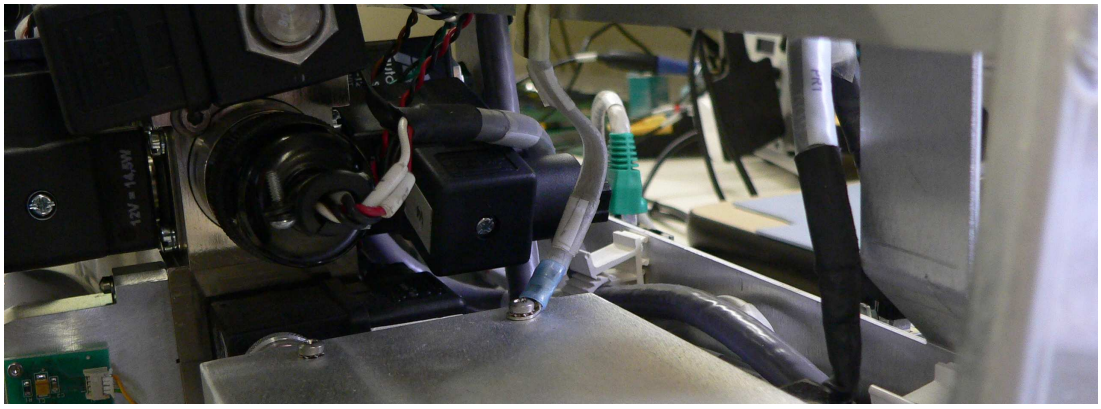

Figure 6-9 Thermocouple

6.2.3 Removing the Valve Block Assembly and Spectrometer

To remove the valve block:

1. Unscrew the Phillips head screw connecting the test port ground wire to the center rail (Figure 6-10).

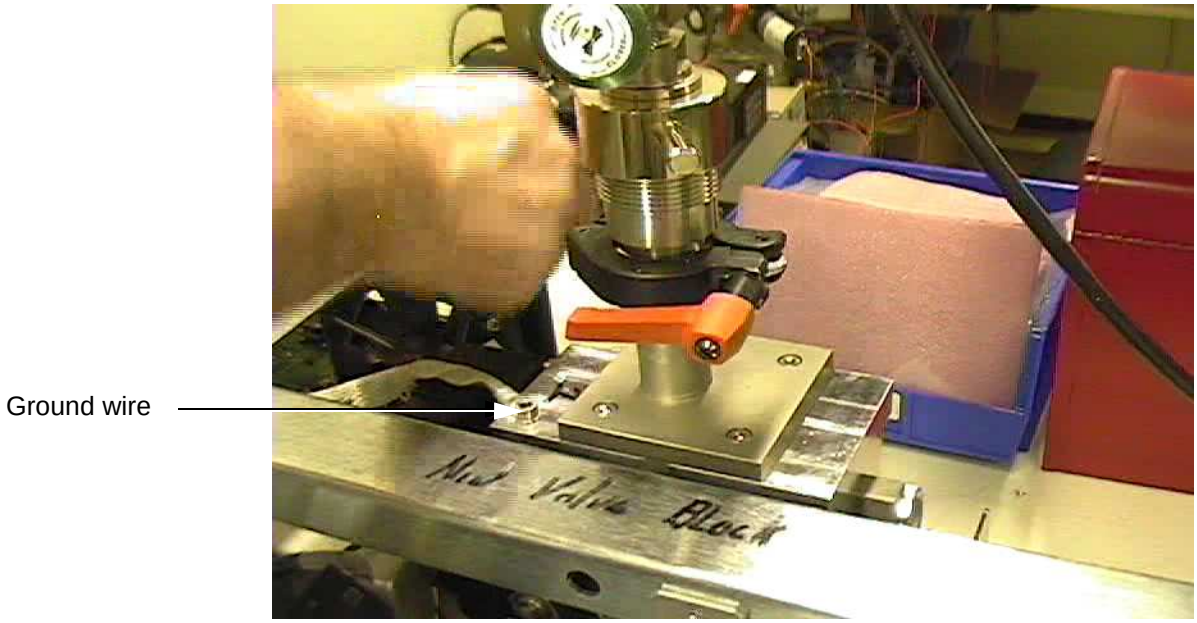

Figure 6-10 Test Port Grounding Wire Connection

2. Loosen, but don't remove, the two bolts for the foreline to valve block connection. Take care not to damage the O-ring (Figure 6-11).

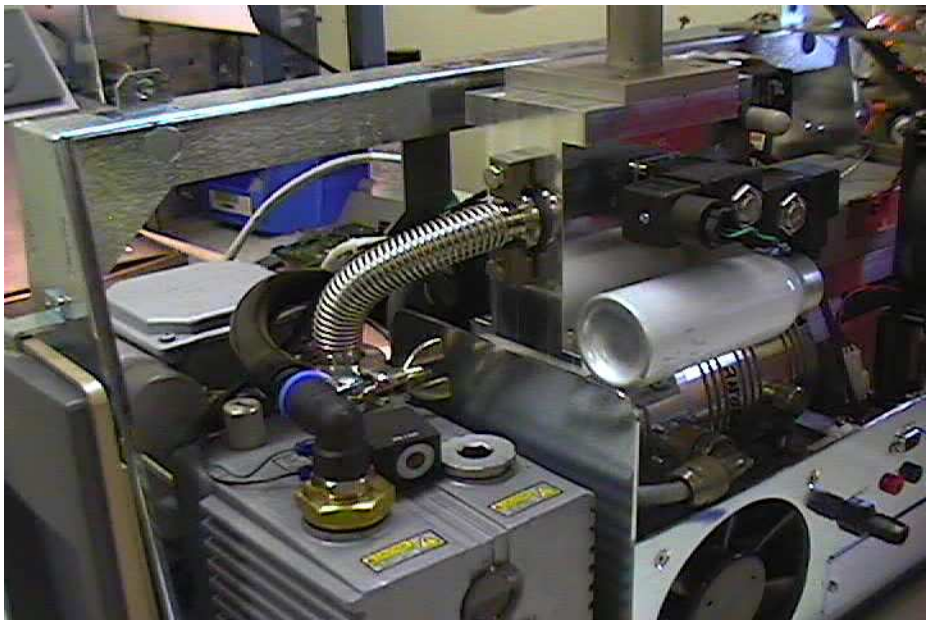

Figure 6-11 Vacuum Connection

3. Remove the ground to the valve block (CONDS) (Figure 6-12).

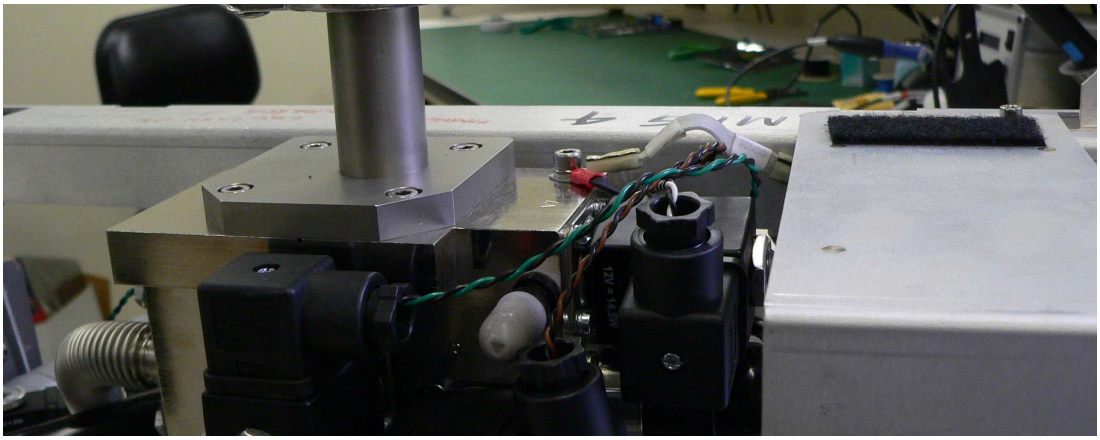

Figure 6-12 Valve Block and TC Ground

4. Unscrew the Phillips screw for the spectrometer ground (SP_GND) (Figure 6-13).

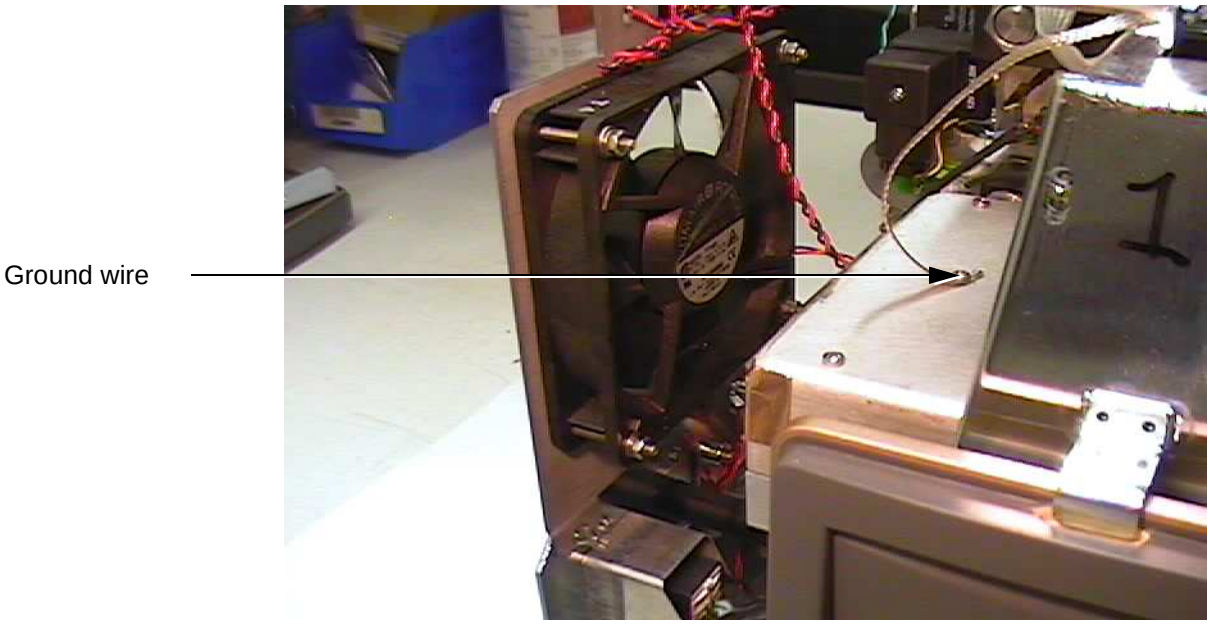

Figure 6-13 Spectrometer Ground Wire

5. Unscrew the five Allen nuts that mount the valve block to the unit (Figure 6-14). Two are shown with the unit already removed for a better view. The spectrometer and turbo pump are shown together.

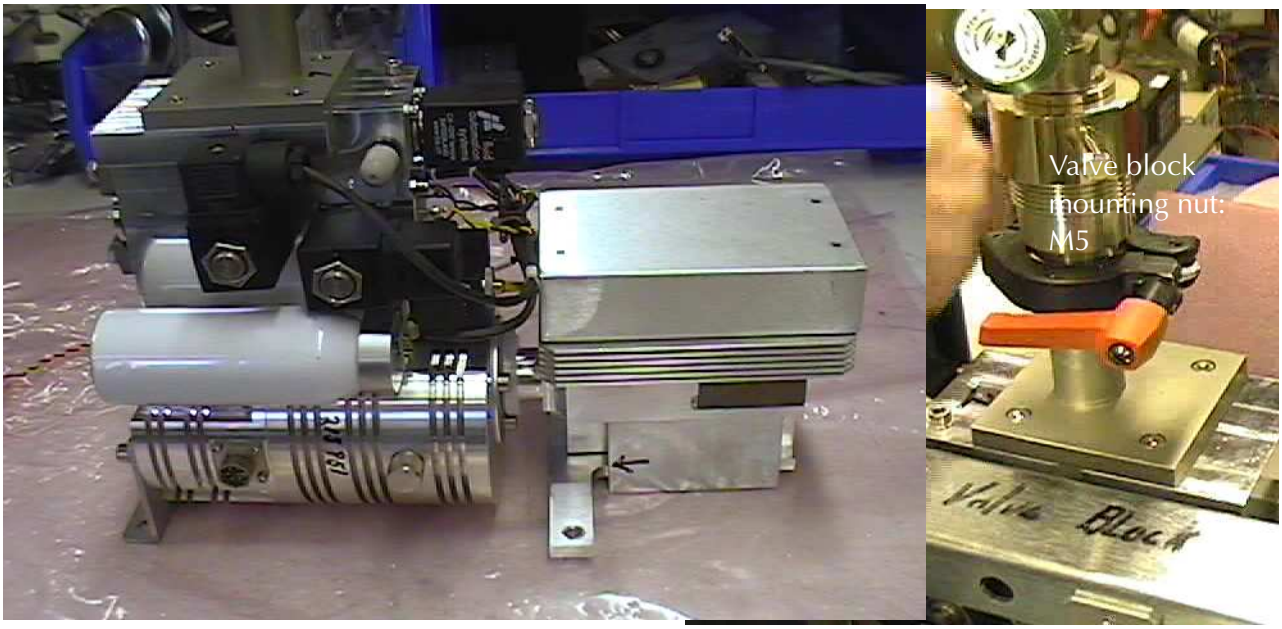

Figure 6-14 Valve Block Assembly and Spectrometer Mounting Nuts

6. Gently pull the valve block assembly straight up and out of the unit. Place the block bottom down on a flat surface (Figure 6-14).
7. Unscrew the knurled nut that connects the vacuum connection to the turbo pump (Figure 6-15).

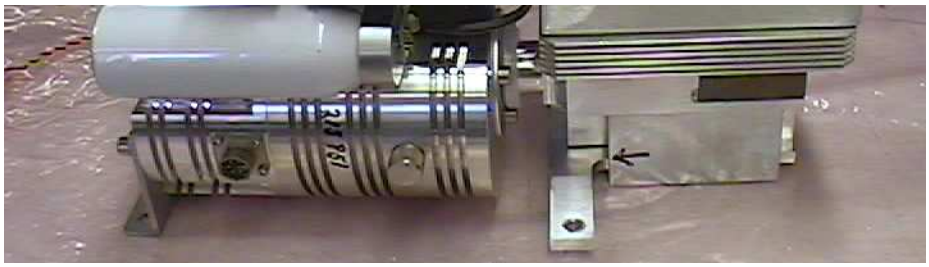

Figure 6-15 Turbo Pump Connector

8. Lift the pump straight up and out of the unit.

6.2.4 Replacing the Turbo Pump, Valve Block and Spectrometer

To reinstall the scroll pump and valve block:

1. Gently place the valve block onto it mounting holes and tighten the five M4 Allen nuts (Figure 6-14 on page 6-10).
2. Reinstall the spectrometer ground wire (Figure 6-13 on page 6-10).
3. Reinstall the ground to the valve block (CONDS).
4. Reinstall the three bolts for the spectrometer connection. Take care not to damage the O-ring (Figure 6-14 on page 6-10).
5. Reinstall the two bolts for the vacuum connection. Take care not to damage the O-ring (Figure 6-11 on page 6-9).
6. Tighten the Phillips head screw connecting the test port ground wire to the center rail (Figure 6-10 on page 6-8).

6.2.5 Replacing the Valve Block Harness and Thermocouple Wiring

To replace the wiring:

1. Replug the valve plugs, screw the Phillips head screw and reattach the wires from the six three-prong blocks (Figure 6-8 on page 6-7).
2. Reattached the thermocouple wires (Figure 6-9 on page 6-8).
3. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 6-1 on page 6-2).
4. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 6-1 on page 6-2).

6.3 Changing the Mechanical Pump Fluid

Refer to the *Mechanical Pump Operation Manual,* provided with the pumps that came with your leak detector. See the accessory item list in this manual for the replacement oil part number.

Section 7. Fan Replacement

7.3.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ M5 Allen Wrench
- ❑ Slotted Screw Driver

There are two cooling fans inside the unit body (Figure 7-1).

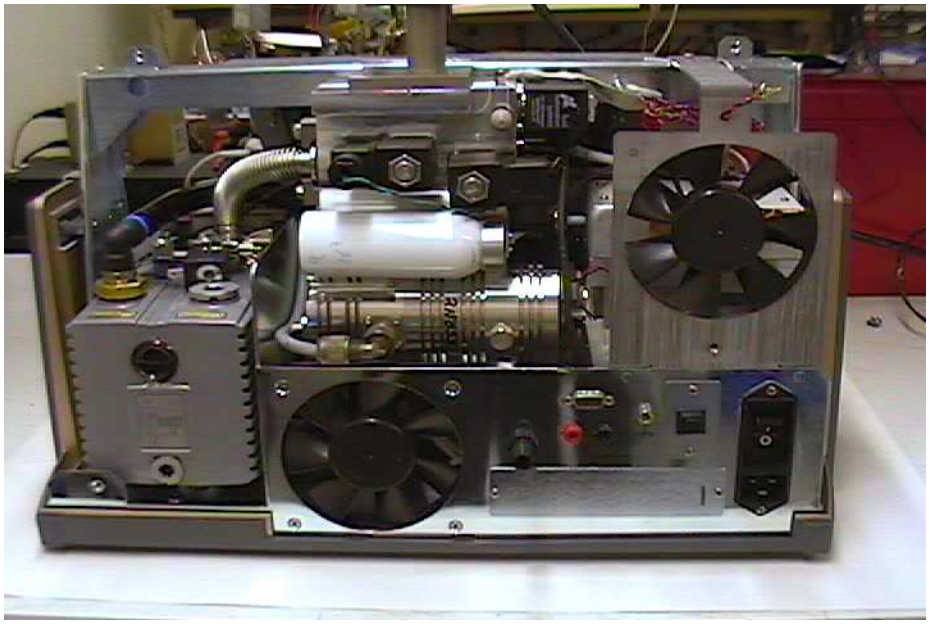

Figure 7-1 Fan Locations

To replace the top fan:

1. Shut down the system using the On/Off rocker switch.
2. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 7-2) and detach the rear plastic cover from the unit.
3. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 7-2).

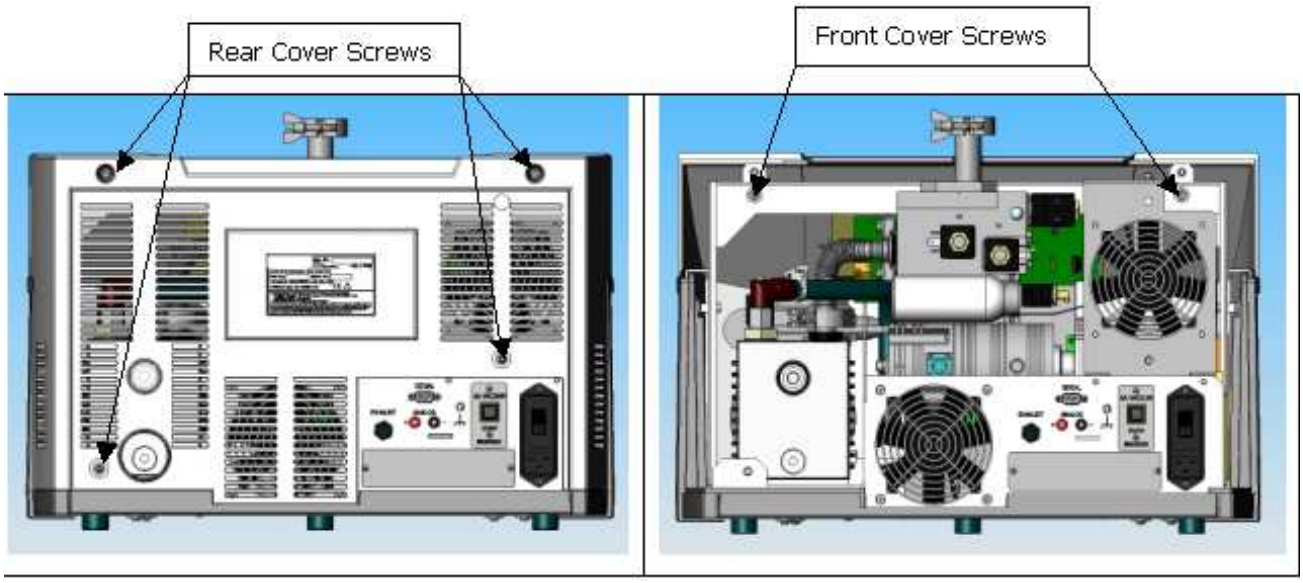

Figure 7-2 Rear and Front Cover Screws

4. Disconnect the red/black wire connector (Figure 7-4).

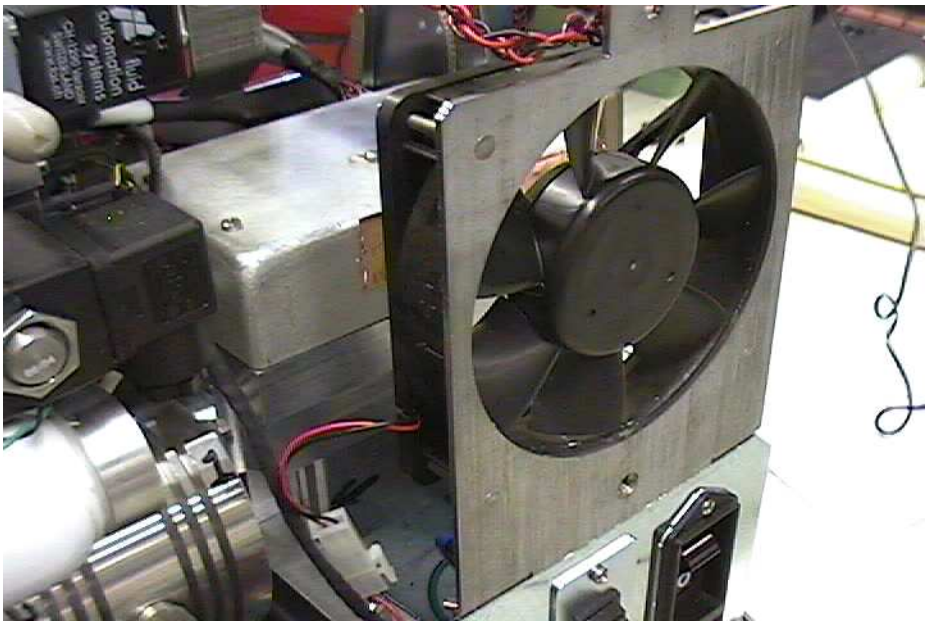

Figure 7-3 Fan Wiring

5. Loosen and remove the four hex nuts, lock washers and washers in the back of the fan in the corners (Figure 7-4).

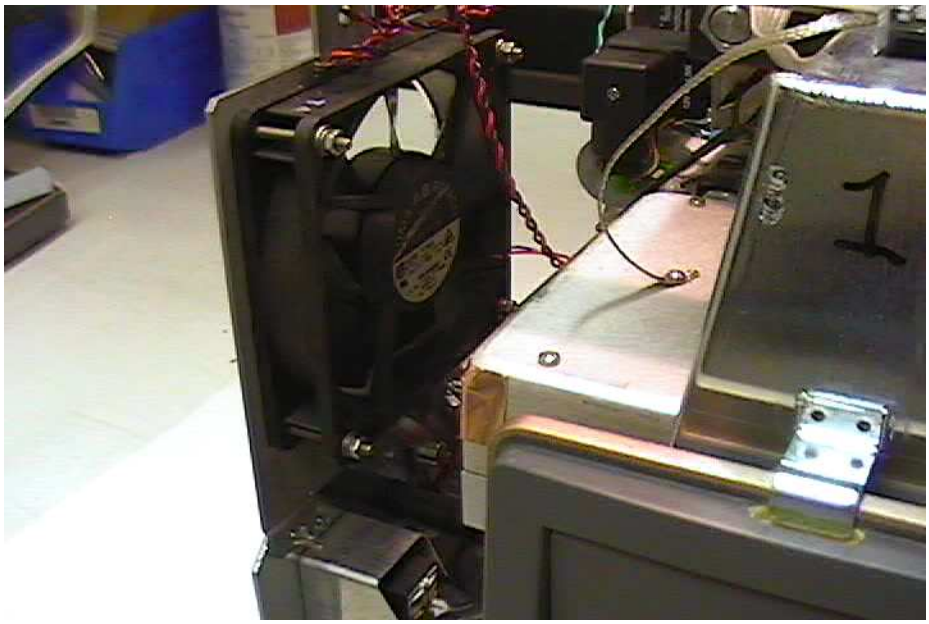

Figure 7-4 Fan Nuts

NOTE *The fan spacers are part of the fan unit and will not loosen.*

6. Mount the replacement fan using the four hex nuts, lock washers and washers.
7. Replace the red/black wire connector.
8. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 7-2 on page 7-2).
9. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 7-2 on page 7-2).

To replace the bottom fan:

1. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 7-5) and detach the rear plastic cover from the unit.
2. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 7-5).

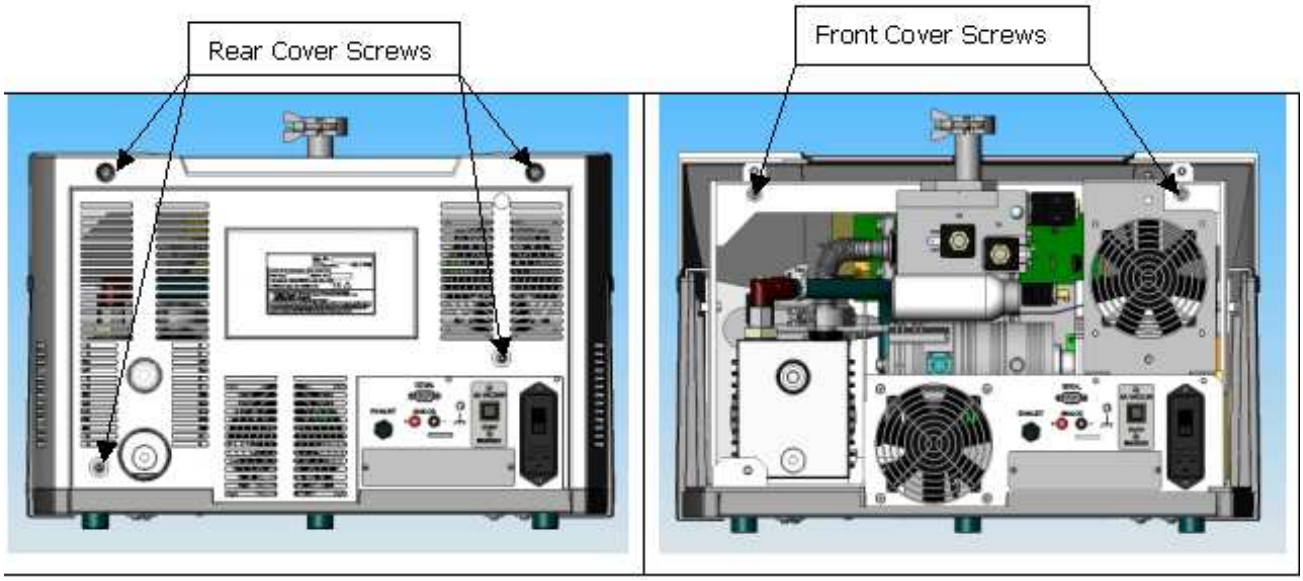

Figure 7-5 Rear and Front Cover Screws

3. Disconnect the red/black wire connector (Figure 7-6).

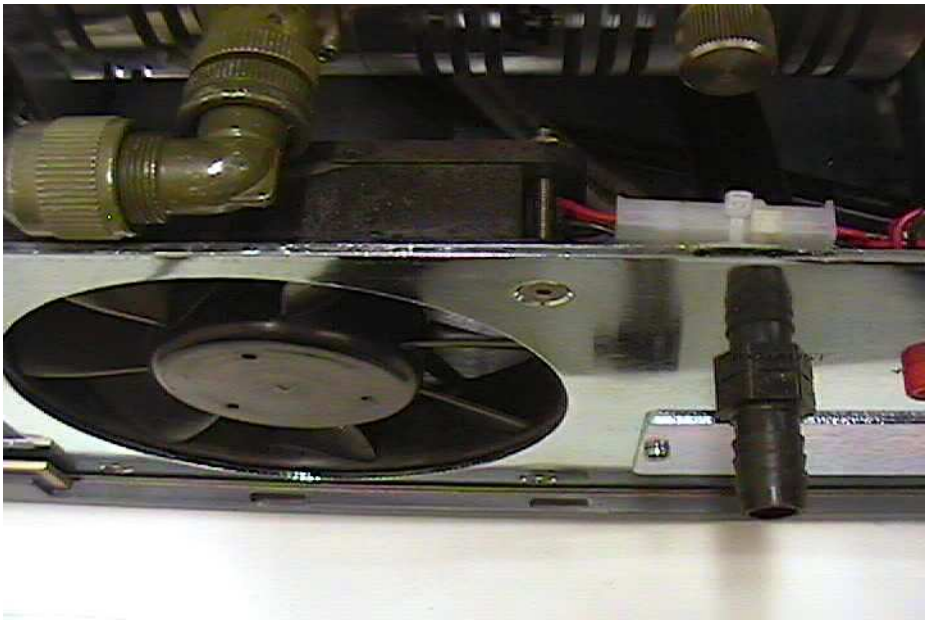

Figure 7-6 Fan Wiring

4. Loosen and remove the four hex nuts, lock washers and washers in the back of the fan in the corners (Figure 7-6).
5. Unplug the fore pump connection (Figure 7-7).

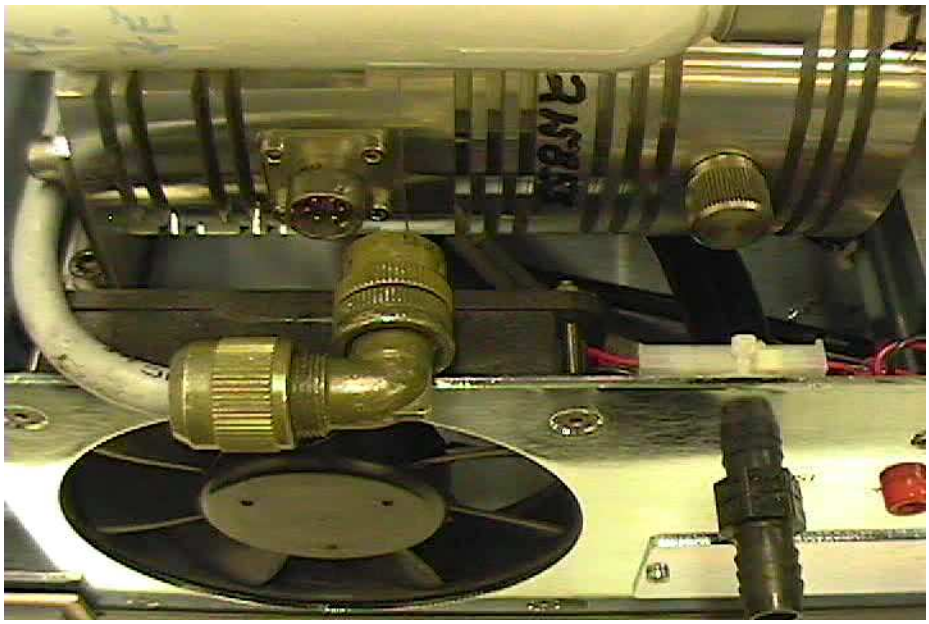

Figure 7-7 Fore Pump Connection

6. Mount the replacement speaker using the four M3 screws and washers.
7. Replace the black and clear spade connections.
8. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 7-5 on page 7-4).
9. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 7-5 on page 7-4).

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Section 8. Power Supply

CAUTION *Always where and ESD bracelet when performing this procedure.*

8.3.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ M5 Allen Wrench
- ❑ Phillips Screw Driver

1. Shut down the system using the On/Off rocker switch.
2. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 8-1) and detach the rear plastic cover from the unit.
3. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 8-1).

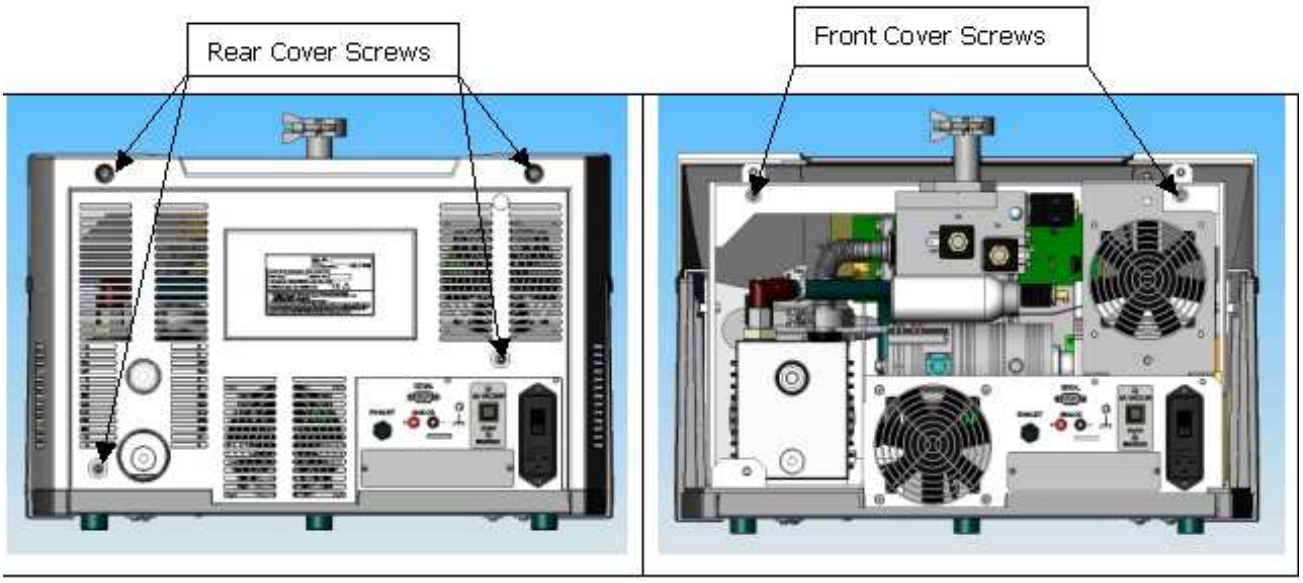

Figure 8-1 Rear and Front Cover Screws

4. Remove the user interface front cover using an Allen wrench to loosen the M4 screw and washer at the bottom front of the plate (Figure 8-2).

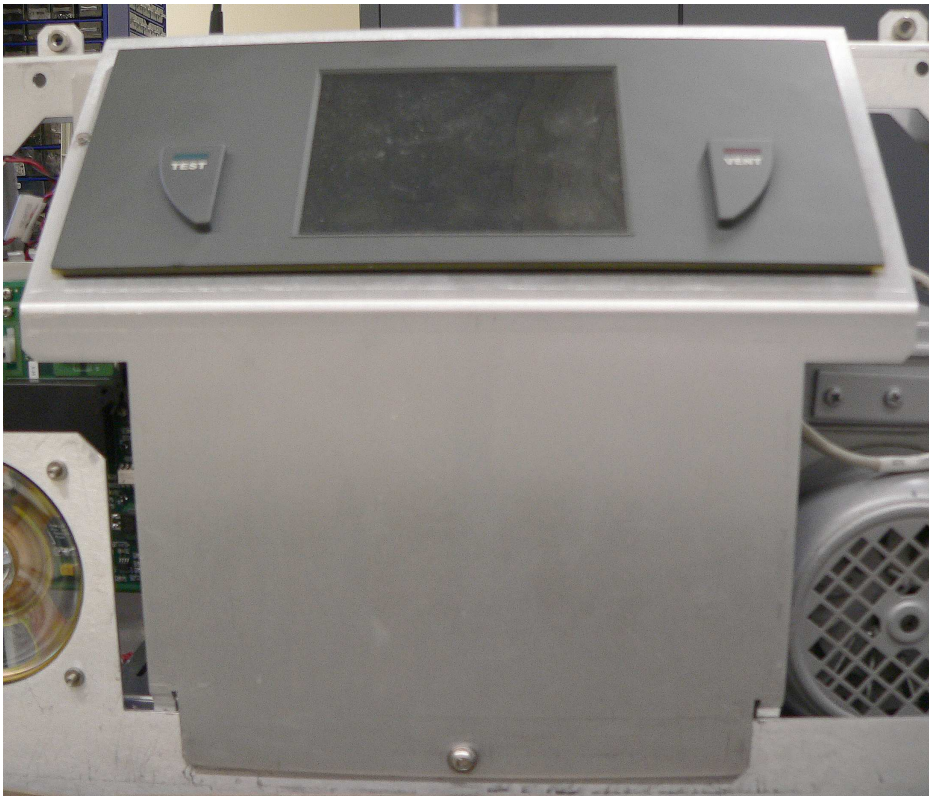

Figure 8-2 User Interface Plate Mounting Screw

5. Gently rock the interface panel up and out.

6. Disconnect (Figure 8-3):
   - ❑ P401 (red/black) wire from position J401
   - ❑ Ground wire from the Front Panel using a small Phillips head screw driver and place washer aside
   - ❑ R2148301 (red/black) wire from position J301 Spkr connection
   - ❑ R2127-301 (green cable) from position J303 COM1 connection
   - ❑ J300-2 from the P300 connector using the two captive screws
7. Remove the assembly and lay it aside.

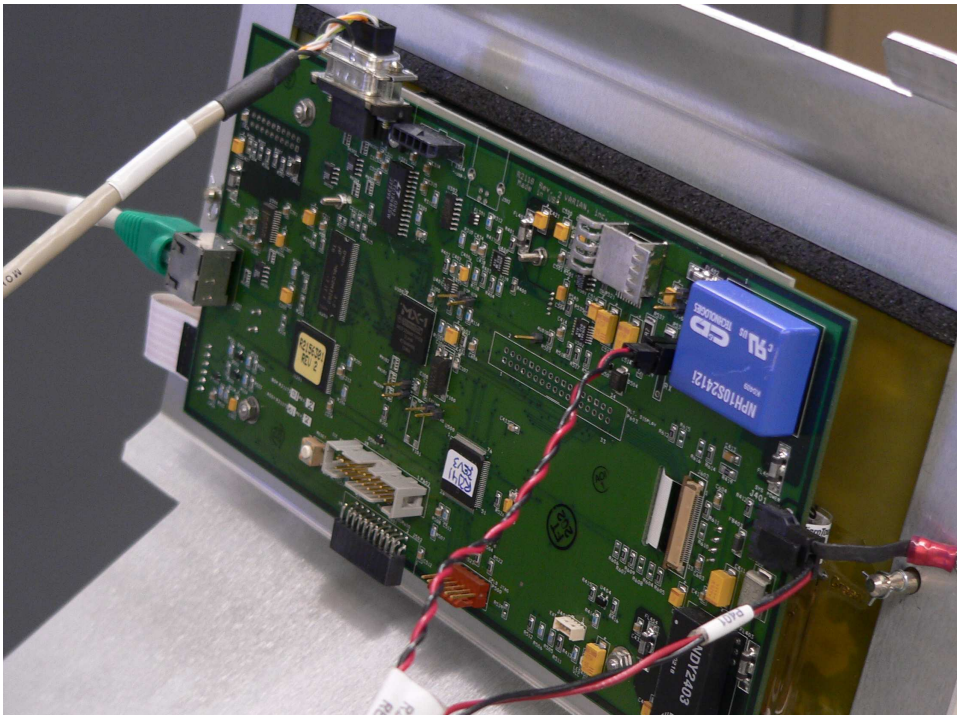

Figure 8-3 Interface Board Wiring

8. Remove the bank of connections shown in Figure 8-4. Label the wires as they are disconnected (from left side):
   - ❑ SP1 goes to L on power supply
   - ❑ SPN goes to N (white) on power supply
   - ❑ SPG (green/yellow) goes to CGND2 on power supply
   - ❑ SP GND goes to GND on power supply
   - ❑ Three red wire lead:
     - ❑ PS1 goes to POS1 +V on power supply
     - ❑ PS2 goes to POS2 +V on power supply
     - ❑ PS3 goes to POS3 +V on power supply
   - ❑ Three black wire lead:
     - ❑ PS4 goes to POS4 -V on power supply
     - ❑ PS5 goes to POS5 -V on power supply
     - ❑ PS6 goes to POS6 -V on power supply

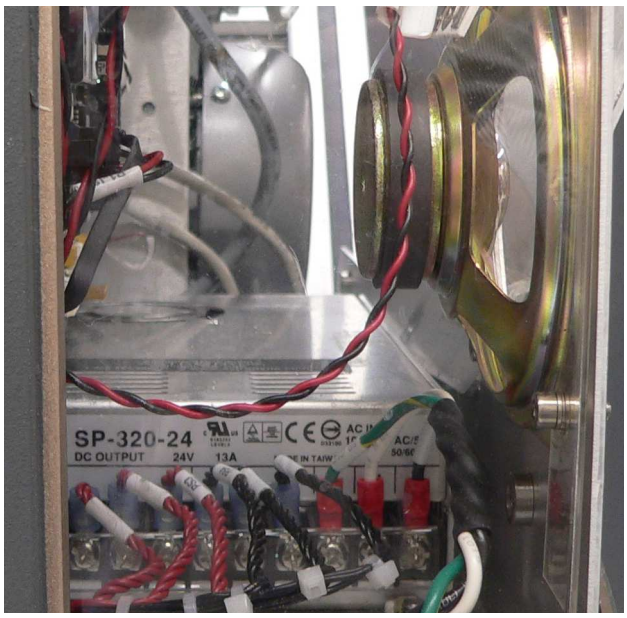

Figure 8-4 Power Supply Connections

WARNING *Use two people for the next step.*

9. Place 6″ blocks under all four corners of the unit.
10. Rock the unit back gently.

CAUTION *Do not exceed 45° or the oil will leak into the unit.*

11. Remove the four Phillips screws on the bottom mounting plate (Figure 8-5).

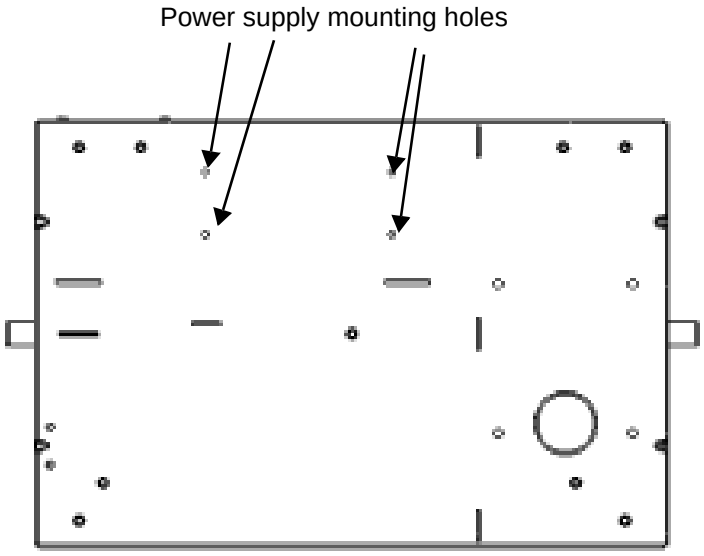

Figure 8-5 Power Supply Mounting Holes

12. Place the new power supply in place and install using the four Phillips screws removed in step 9.

WARNING *Use two people for the next step.*

13. Remove the 6″ blocks.
14. Reinstall the bank of connections shown in Figure 8-4 on page 8-4:
    - ❑ SP1 goes to L on power supply
    - ❑ SPN goes to N (white) on power supply
    - ❑ Black (green/yellow) goes to CGND2 on power supply
    - ❑ SP GND goes to GND on power supply
    - ❑ Three red wire lead:
        - ❑ PS1 goes to POS1 +V on power supply
        - ❑ PS2 goes to POS2 +V on power supply
        - ❑ PS3 goes to POS3 +V on power supply

- ❑ Three black wire lead:
  - ❑ PS4 goes to POS4 -V on power supply
  - ❑ PS5 goes to POS5 -V on power supply
  - ❑ PS6 goes to POS6 -V on power supply

15. Reconnect:
    - ❑ P401 (red/black) wire from position J401
    - ❑ Ground wire from the Front Panel using a small Phillips head screw driver and place washer aside
    - ❑ R2148301 (red/black) wire from position J301 Spkr connection
    - ❑ R2127-301 (green cable) from position J303 COM1 connection
    - ❑ J300-2 from the P300 connector using the two captive screws
16. Reinstall the speaker wire, green plug, ground and red/black wire connector at the interface board (Figure 8-3 on page 8-3).
17. Replace the user interface front cover using an Allen wrench to tighten the M4 screw and washer at the bottom front of the plate (Figure 8-2 on page 8-2).
18. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 8-1 on page 8-1).
19. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 8-1 on page 8-1).

Section 9. Speaker Replacement

9.3.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Slotted Screw Driver

To replace the speaker:

1. Shut down the system using the On/Off rocker switch.
2. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 9-1) and detach the rear plastic cover from the unit.
3. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 9-1).

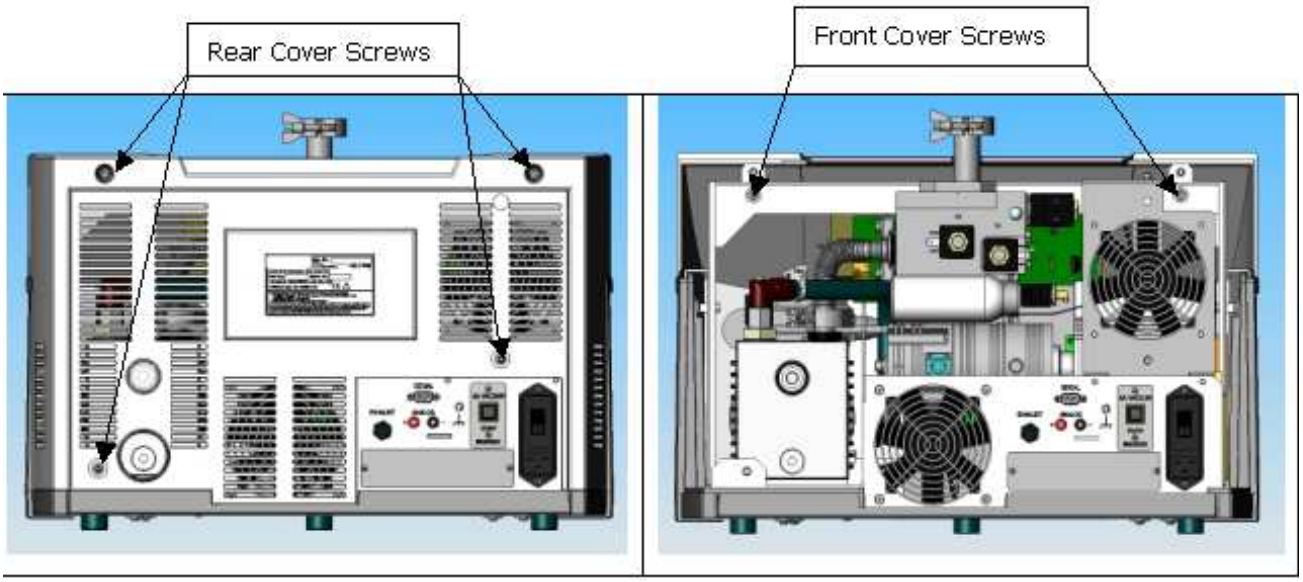

Figure 9-1 Rear and Front Cover Screws

4. Disconnect the speaker black (SPK2) and red spade connections (SPK1) (Figure 9-2).

NOTE

The speaker connects to the J50 connector on the Front Panel board.

5. Use a nut driver to loosen and remove the four M3 screws in the speaker corners (Figure 9-2). Remove the plastic protective shell and place it aside.

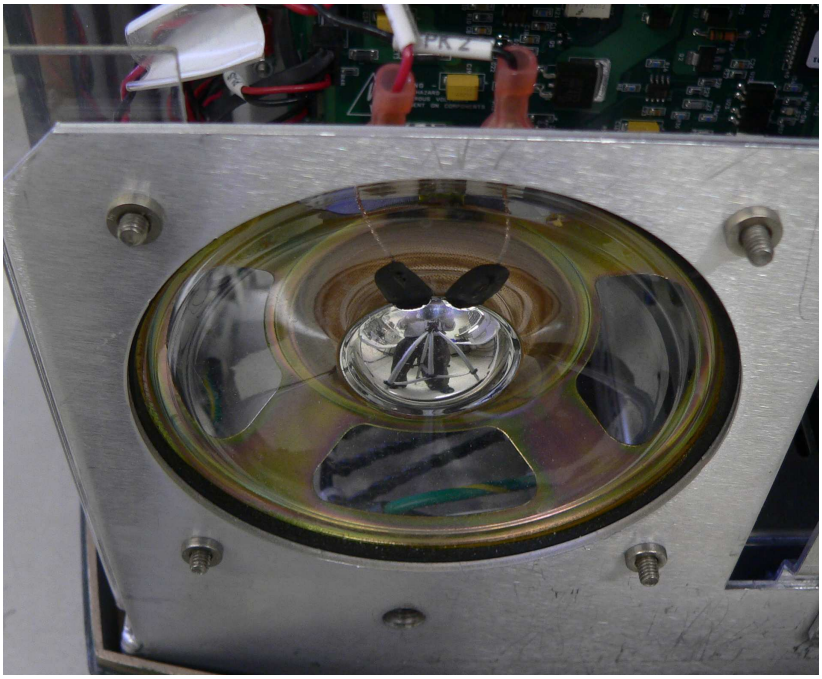

Figure 9-2 Speaker Nuts and Wiring

6. Mount the replacement speaker and plastic shield using the four M3 screws and washers.
7. Replace the black and red spade connections.
8. Reinstall the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 9-1 on page 9-1).
9. Using an extended length M5 Allen wrench, reinstall the four screws holding the rear plastic cover (Figure 9-1 on page 9-1).

Section 10. Filament Replacement

10.1 Installation Procedure

10.1.1 Equipment Required

- ❑ Filament Service Kit (PN: VSFLDFR)
- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ Needle nose pliers or tweezer
- ❑ M3 Phillips Head Screw Driver
- ❑ 1.5 mm Hex Driver
- ❑ 5 mm Hex Driver
- ❑ Torque Wrench (must be adjustable to 40 in-lbs (4.5 N-m) and 90 in-lbs (10.2 N-m))
- ❑ Digital Multimeter (Fluke 187 or equivalent)

For clarity, some items have been omitted from views.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 10-1).

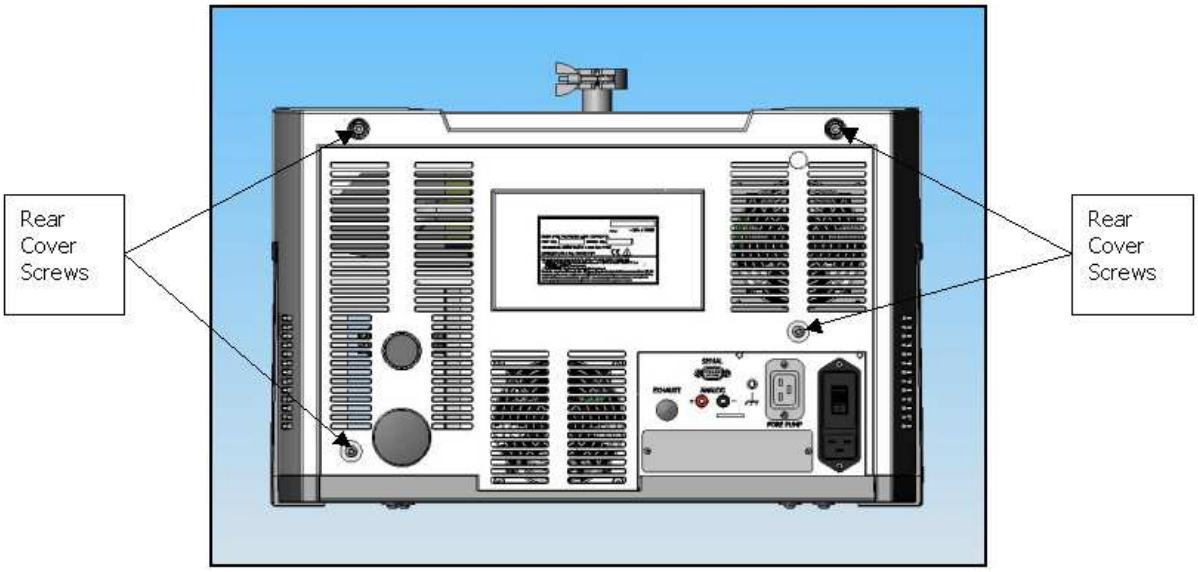

Figure 10-1 Rear Screws

4. Detach the rear plastic cover from the unit.
5. Disconnect the fan cable and remove the fan assembly by unfastening two wing nuts and one M4 socket head cap screw (Figure 10-2).

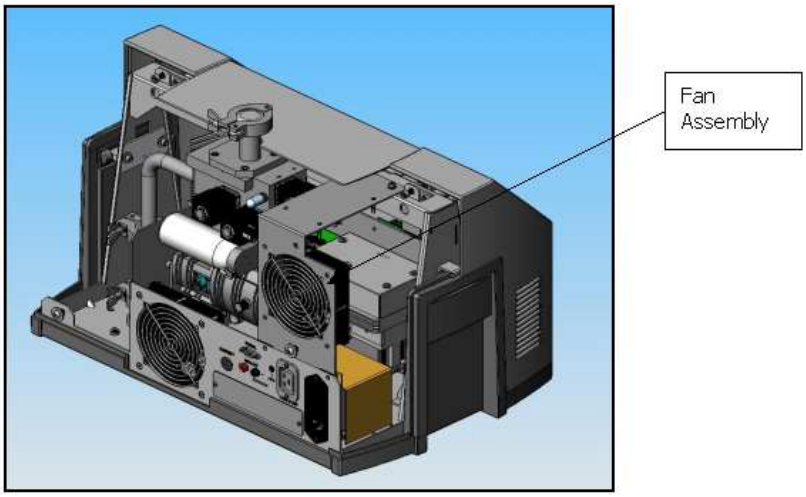

Figure 10-2 Fan Assembly

CAUTION *Static sensitive device, ensure that personnel are properly grounded before proceeding.*

6. Disconnect the spectrometer ground cable, the preamp signal cable and the ion source cable from the spectrometer (Figure 10-3).

NOTE *Cables not shown for clarity.*

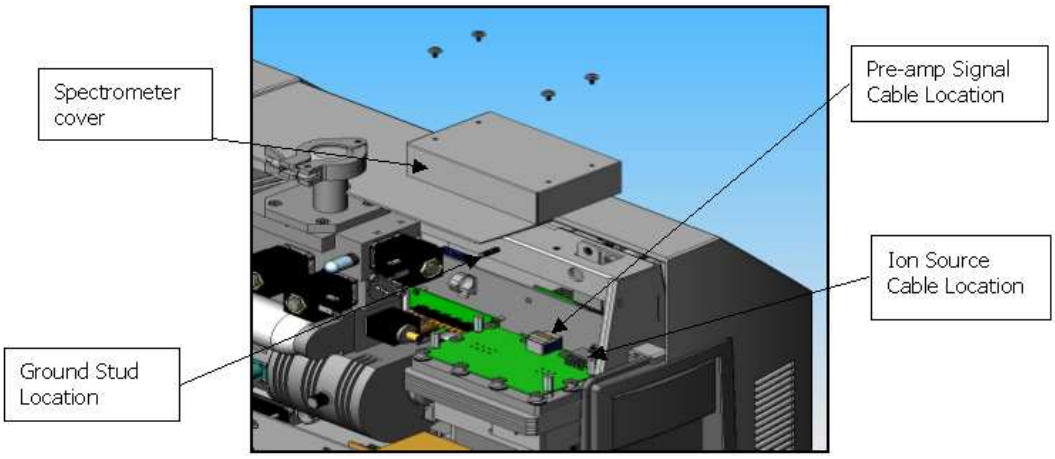

Figure 10-3 Cable Locations

7. Using an M3 Phillips screw driver, remove the spectrometer cover.

CAUTION

Wear non-powdered, ESD-safe Nitride or equivalent gloves (not included in kit) to prevent skin oils from getting on vacuum surfaces.

8. Loosen screws (item 1, Figure 10-4) and carefully remove the spectrometer header from the body. The vacuum system vents to atmosphere as the screws are loosened. Retain the socket head cap screws (item 1) and the Belleville washers (item 2). See line item 21 for correct orientation of the Belleville washers (Figure 10-10 on page 10-6).

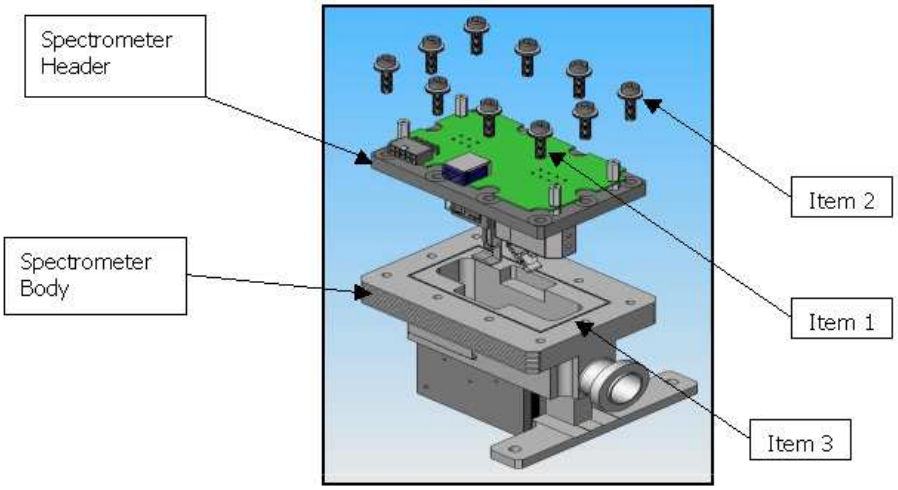

Figure 10-4 Spectrometer Exploded View

9. Remove the metal gasket (item 3) and discard. Do not scratch the mating surface when removing the gasket. Do not attempt to reuse the gasket (Figure 10-4).
10. Examine the spectrometer cavity for discolored areas. If present, refer to the service manual for cleaning instruction.

11. On a clean work surface, remove the defective filament(s) (item 4) from the spectrometer by loosening the two coupler screws. Then loosen the M2 screw and washer and remove the defective filament (Figure 10-5).

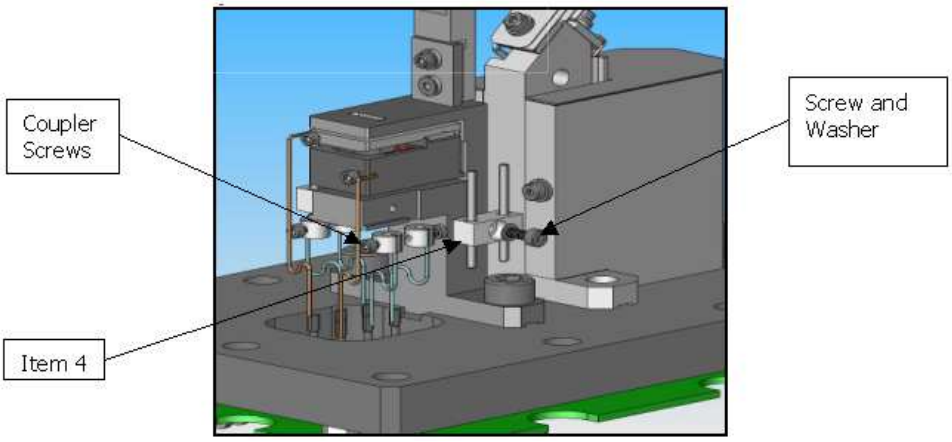

Figure 10-5 Coupler Screws

12. Inspect the new filament assembly for deformation, damage and flaking of the coating prior to installation. Do not install if damaged.
13. Insert new filament assembly into the coupler.
14. Guide the ceramic against the bottom and side ribs of the ion source support block (Figure 10-6 and Figure 10-7). Correct positioning of filament is critical for proper spectrometer operation.

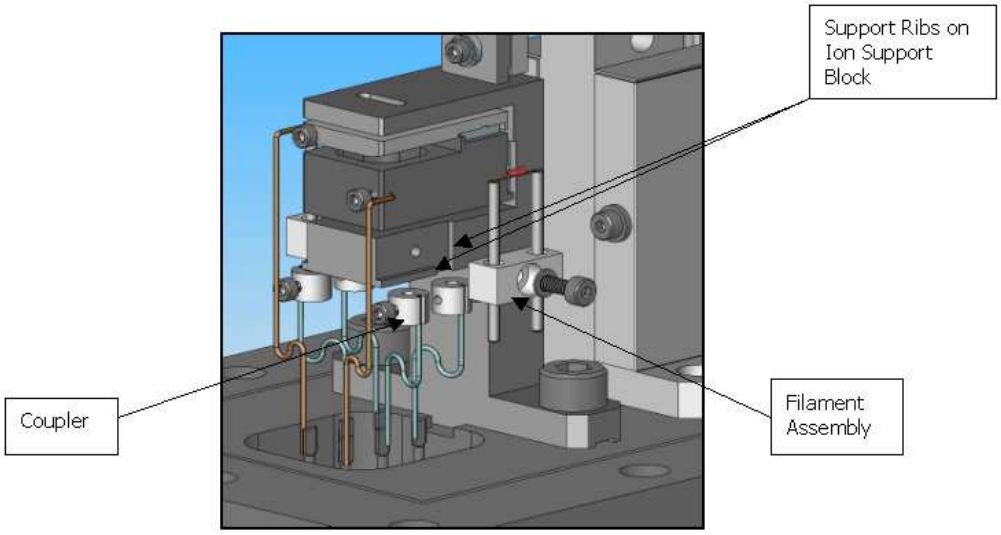

Figure 10-6 Coupler and Filament Assembly

15. While holding the filament in position, insert the M2 screw and washer and tighten (Figure 10-7).
16. Tighten the coupler screws onto the filament posts (Figure 10-7).

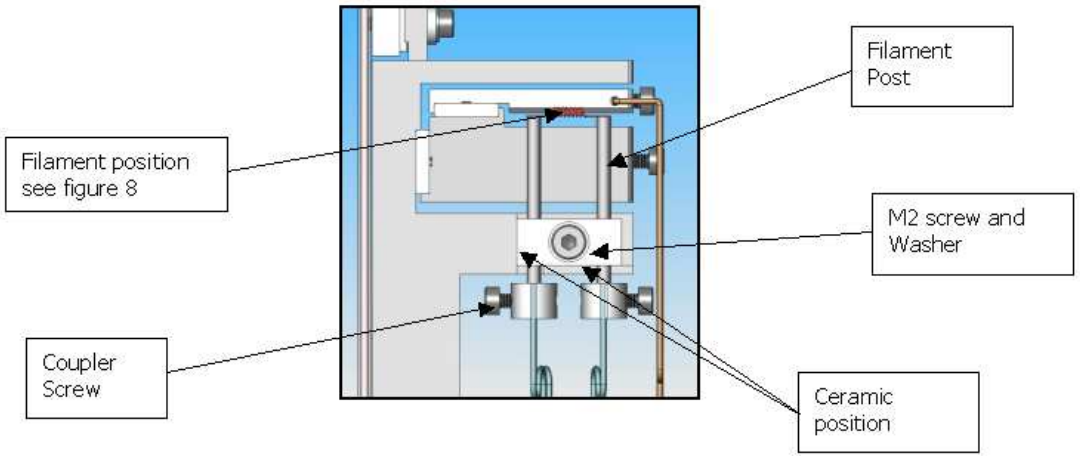

Figure 10-7 Filament Position

17. Verify ceramic is tight against the bottom and right side ribs. Ensure that the filament is positioned in the slot of the ion source as shown (Figure 10-7 and Figure 10-8).

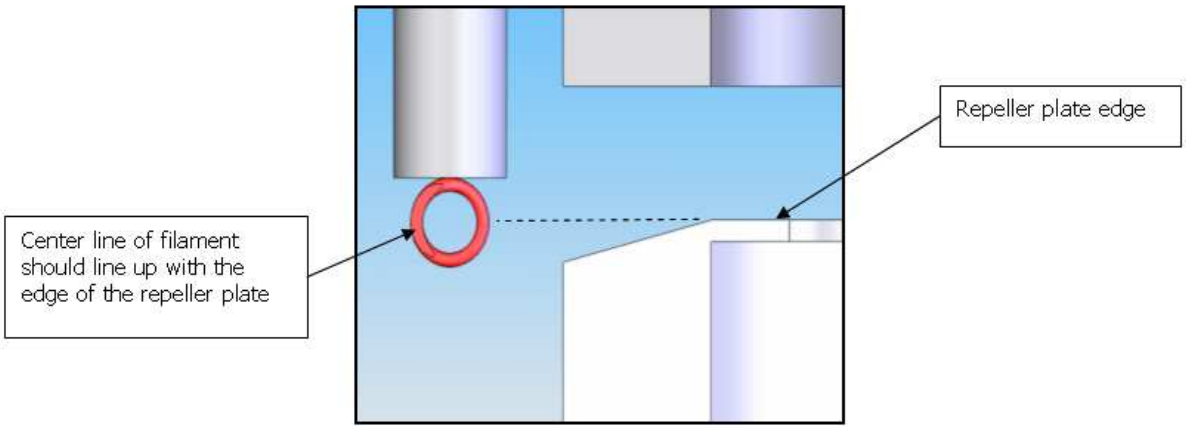

Figure 10-8 Filament Alignment

18. Clean the mating surfaces of the spectrometer body and header with Isopropyl alcohol and a clean lint free wipe.

NOTE

Agilent recommends that you use the Vac-u-solv spectrometer cleaning kit (PN: 670029096).

19. Center replacement metal gasket inside the bolt pattern and outside of the body cavity. To prevent scratching of any sealing surface do not use metal tools for this task.

20. Guide the spectrometer header into pocket with the detector housing closest to the inlet (Figure 10-9).

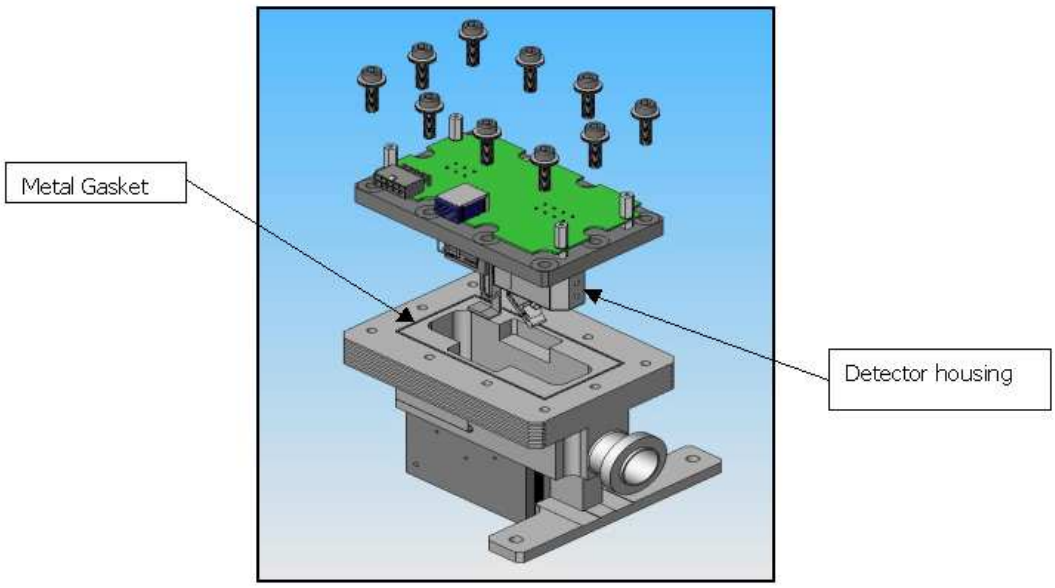

Figure 10-9 Figure 9: Spectrometer Alignment

21. Insert a screw with three Belleville washers into each hole and finger tighten (Figure 10-10).

NOTE

The cones of the Belleville washers should all point to the head of the screw.

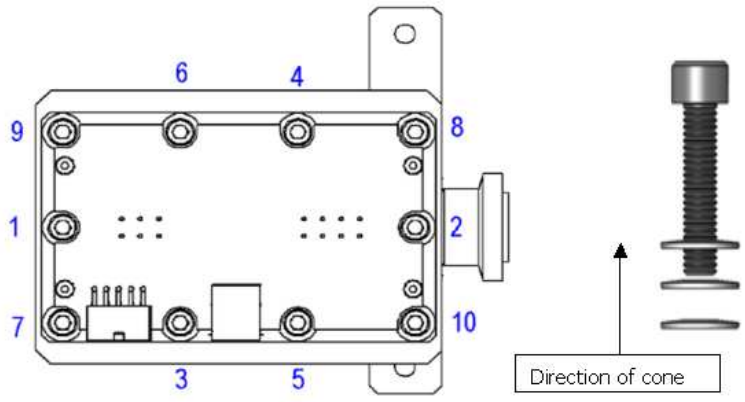

Figure 10-10 Direction of Cone

22. Following the pattern shown in Direction of Cone, torque screws to 40 in-lbs (4.5 N-m).
23. Re-torque screws to 90 in-lbs (10.2 N-m) following the same pattern. Go through the entire torque pattern twice to ensure the metal gasket is firmly compressed.

24. Wait a minimum of five minutes then torque the screws shown in pattern (Figure 10-10) to 90 in-lbs (10.2 N-m).
25. On the PCB, use the resistance meter to verify an open circuit between any two of the six ion source header pins (except FIL-1 to FIL-1 and FIL-2 to FIL-2 which should be 0.3 Ohms or less). Also verify an open circuit between the body of the spectrometer and any of the ion source header pins (Figure 10-11).

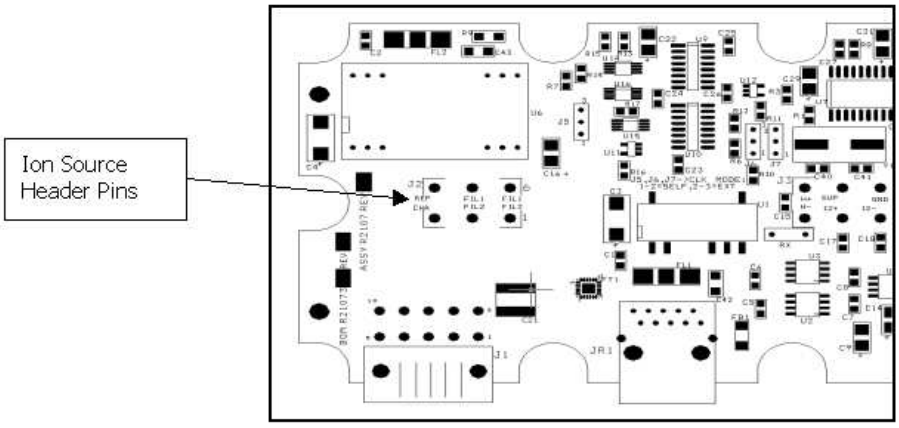

Figure 10-11 Ion Source Header Pin Schematic

If there is continuity (short circuit) at any of the points, remove the header and inspect for shorting.

26. Place the spectrometer cover over the header and align the holes (Figure 10-12).

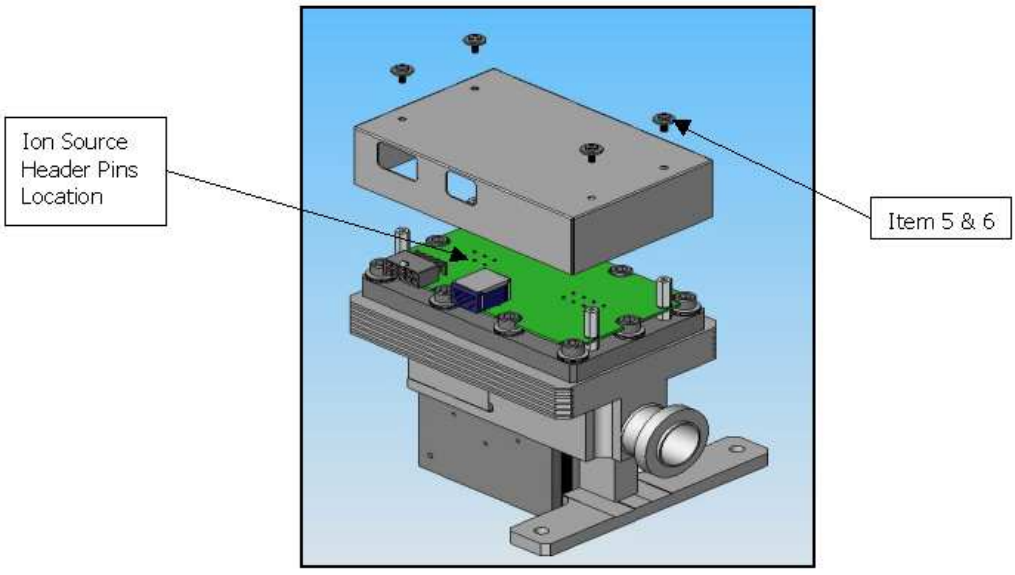

Figure 10-12 Ion Source Header Pin Locations

27. Install screws and washers (items 5 & 6), then tighten using a M3 Phillips screw driver (Ion Source Header Pin Locations).

28. Connect the spectrometer ground cable, the preamp signal cable and the ion source cable to the spectrometer cover.
29. Ensure that the vent valve on the turbo molecular pump (if installed) is tightened (Figure 10-13).

NOTE *The vent valve is not installed on most turbo pumps.*

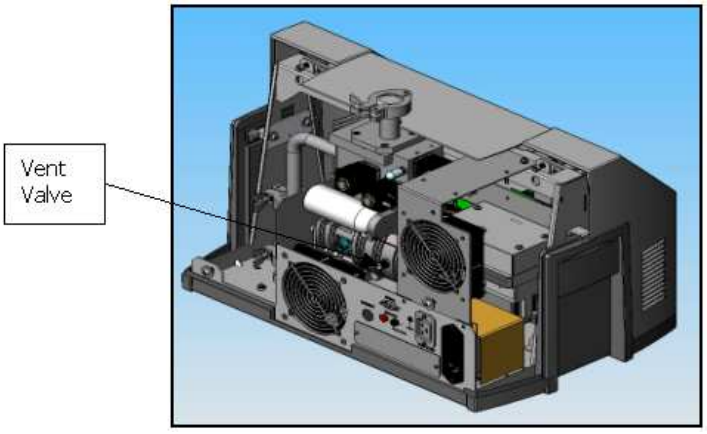

Figure 10-13 Vent Valve

30. Attach the fan assembly (Figure 10-2 on page 10-2) by fastening two wing nuts and one M4 socket head cap screw. Then connect the fan cable to the unit.
31. Leak check the spectrometer to ensure a leak free joint.
32. Attach the rear cover and secure to the unit using existing hardware.
33. Power up the unit.
34. Watch the Home screen to verify that the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes. Refer to the user manual if the system fails to reach the *System Ready* mode.

    The filament emission current normally operates at 0.8mA.
35. Use the display menus (MENUS, SET-UP, MANUAL TUNING, EMISSION) to set the emission to.8mA.

NOTE *Agilent recommends that you wait a minimum of 30 minutes for the vacuum system to clean up to obtain optimum calibration.*

36. Calibrate the system per the user manual. For proper operation the system must be calibrated after opening the spectrometer or changing a filament.

37. If the system fails calibration, adjust the filament emission current as follows:

    - ❑ If gain is too low, there is too much signal; reduce emission current (by 0.1 - 0.2mA), then calibrate again.
    - ❑ If gain is too high, there is too little signal; increase emission, then calibrate again.

    The permitted emission current range is from 0.5 to 1.5 mA.

    When calibration is successful, filament replacement is complete.

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Section 11. Thermocouple Gauge and Octal Cable Replacement

11.1 Installation Procedure

11.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set

For clarity, some items have been omitted from views.

WARNING

Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.

NOTE

Some early versions of this instrument used one assembly that incorporated a TC gauge and cable. If you need to replace one of these early assemblies, you will need to replace the TC gauge (VSFLDOG) and the cable assembly (VSFLDOC).

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 11-1) and detach the rear plastic cover from the unit.

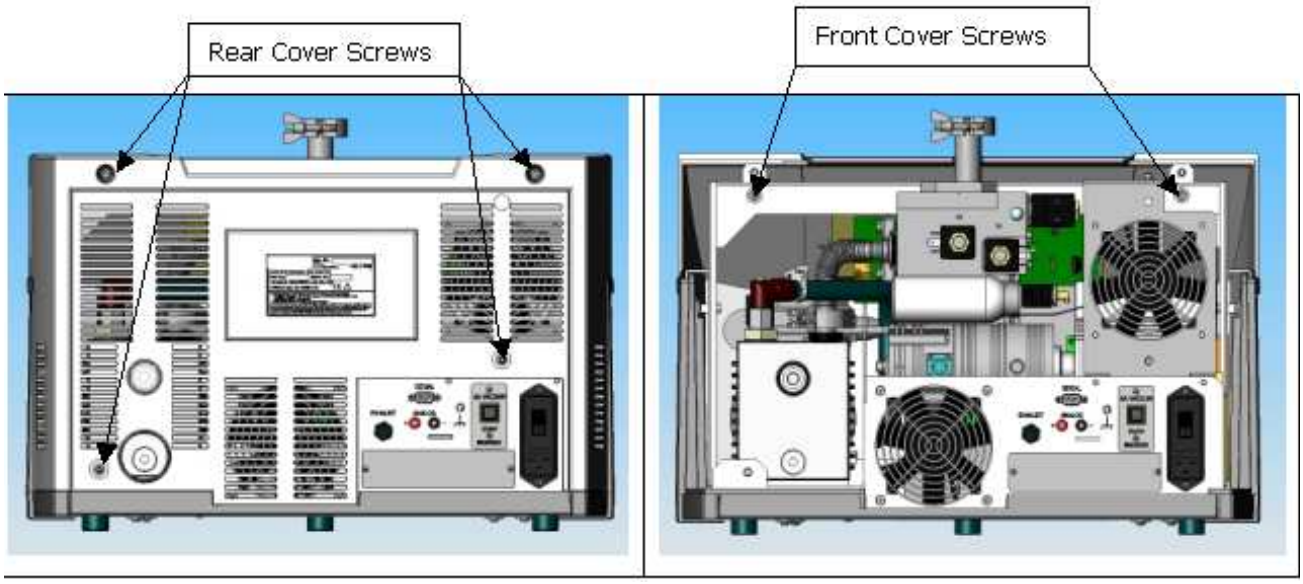

Figure 11-1 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 11-1).

NOTE *Cables not shown for clarity.*

5. Disconnect the fan cable and remove the fan assembly by unfastening two wing nuts and one M4 socket head cap screw (Figure 11-2).

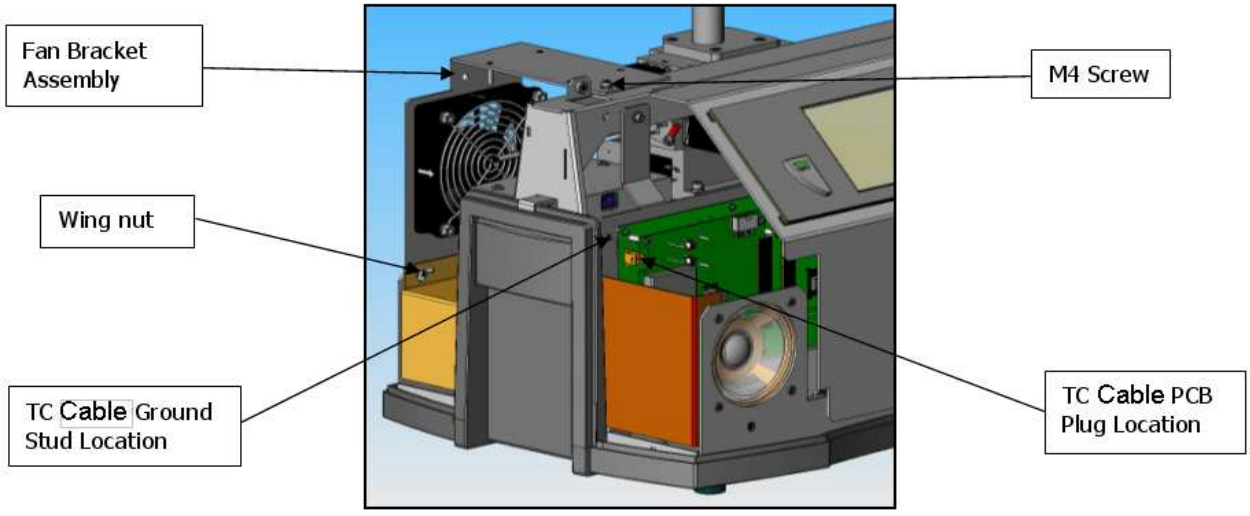

Figure 11-2 Fan and TC Gauge Assemblies

6. Replace the TC Gauge (VSFLDOG) by:
   a. Disconnecting the octal connector from the TC gauge (Figure 11-3).

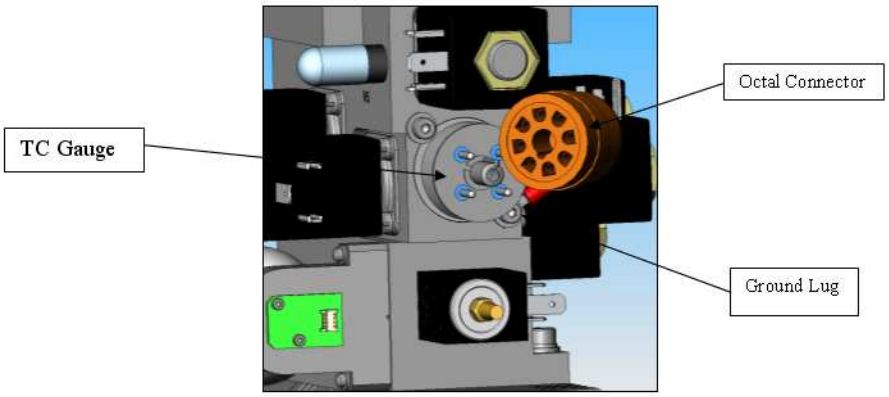

Figure 11-3 Octal Cable

   b. Using an M4 Allen wrench to remove the TC gauge from the valve block. Retain both screws and the two washers, and discard the old TC Gauge and O-ring.
   c. Placing the new O-ring onto the replacement TC Gauge.
   d. Installing the replacement TC Gauge: orientate the TC vent towards the base of the valve block (6 o'clock position) and loosely install existing hardware (Figure 11-4).

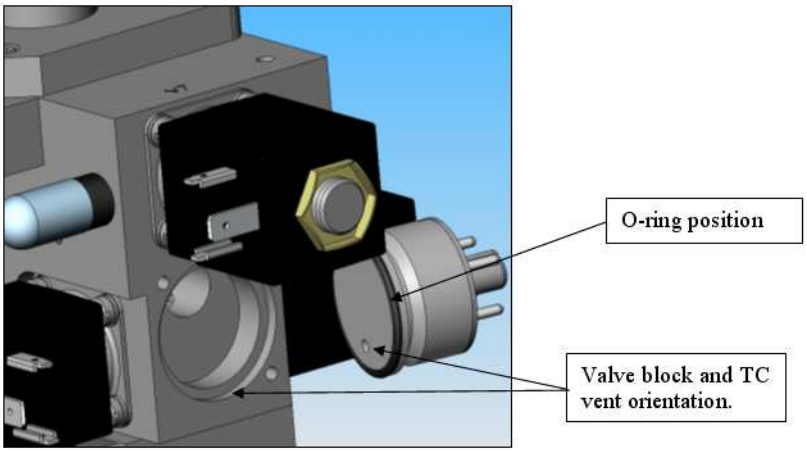

Figure 11-4 Thermocouple Gauge Orientation

e. Installing the ground lug between the washer and the screw (Figure 11-5) and secure the existing hardware using an M4 Allen wrench.

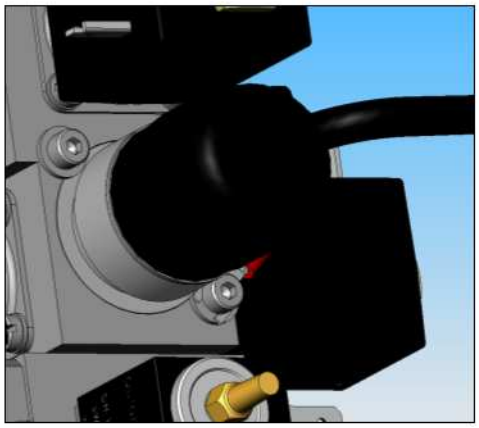

Figure 11-5 Figure 5: Ground Lug Position

f. Reconnecting the octal connector to the TC Gauge (Figure 11-5).

g. If an Octal cable installation is required then proceed to step 7, otherwise proceed to step 8.

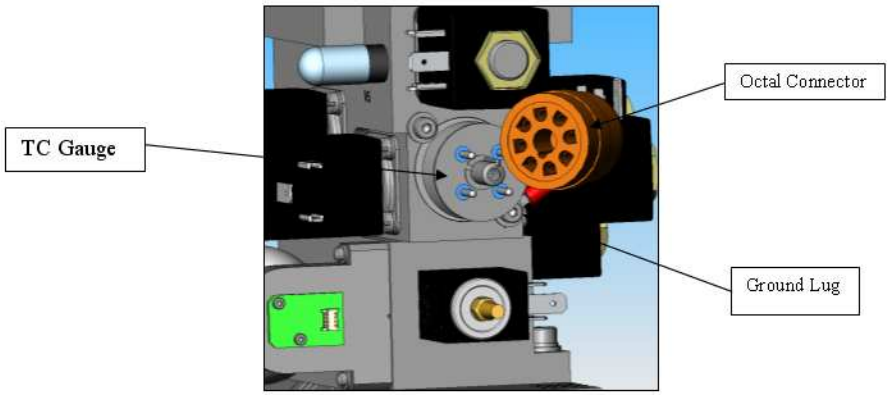

Figure 11-6 Octal Cable

7. Replace the octal cable (VSFLDOC) by:

   a. Disconnecting the octal connector from the TC gauge (Figure 11-3 on page 11-3).

   b. Using an M4 Allen wrench, loosen the lower TC gauge screw and remove the ground lug (Figure 11-3 on page 11-3).

   c. Detaching the cable plug from the mother board PCB and disconnecting the ground cable form the chassis (Figure 11-2 on page 11-2).

   d. Removing the octal cable from the cable ties and discard.

   e. Routing the replacement octal cable back through the assembly in the same position as the removed cable.

f. Attaching the cable plug and the chassis ground to the location (Figure 11-2 on page 11-2).

g. Installing the ground lug between the washer and screw and securing it using an M4 Allen wrench.

h. Attaching the octal connector to the TC gauge.

8. Attach the fan assembly (Figure 11-2 on page 11-2) by fastening the two wing nuts and one M4 socket head cap screw. Then connect the fan cable to the unit.
9. Attach the front cover and secure to the frame using existing hardware.
10. Leak test the TC gauge to ensure a leak free joint.
11. Attach the rear cover and secure to the frame using existing hardware.
12. Connect the power cord and power up the unit.
13. Watch the home screen to verify that the *Spectrometer Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the System Ready mode.

14. Refer to the TC gauge calibration section of the user's manual for the correct calibration procedure for the TC gauge.
15. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 12. Compression Port Adapter Kit

12.1 Installation Procedure

12.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ Compression Port Adapter Kit (P/N VSFLDCP)

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 12-1) and detach the rear plastic cover from the unit.
4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 12-1).

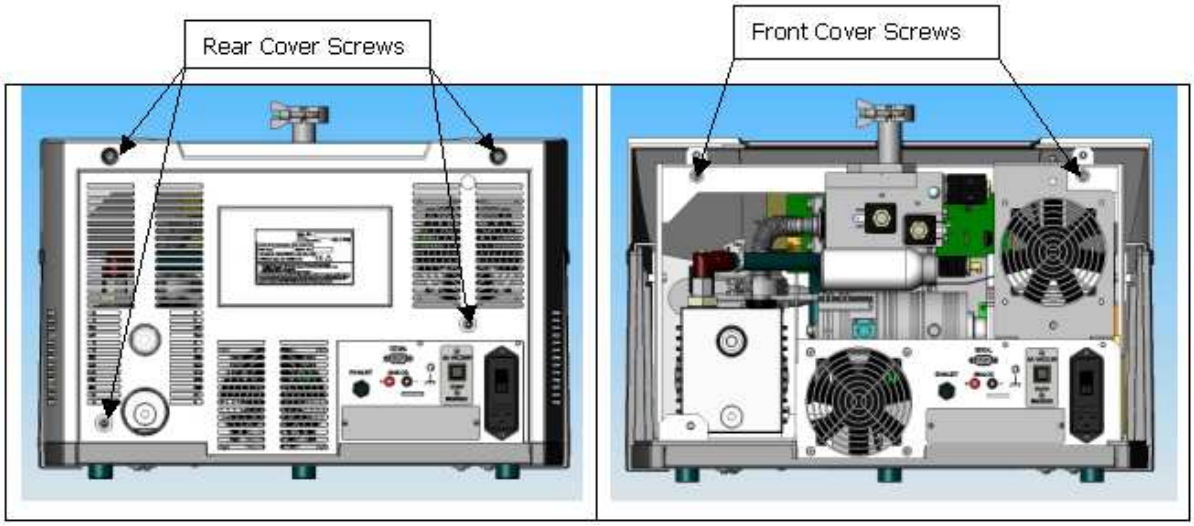

Figure 12-1 Rear and Front Cover Screws

NOTE *Cables not shown for clarity.*

5. Using an M5 allen wrench remove the four screws and disconnect the compression test port flange (Figure 12-2). Do not discard hardware.

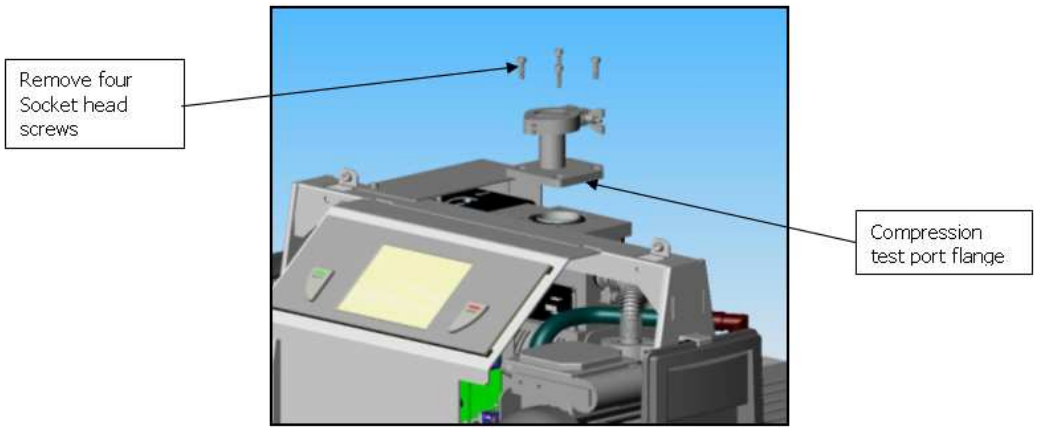

Figure 12-2 Compression Test Port Flange

NOTE *Cables not shown for clarity.*

6. Attach new compression port adapter kit using existing hardware and O-ring (Figure 12-3).

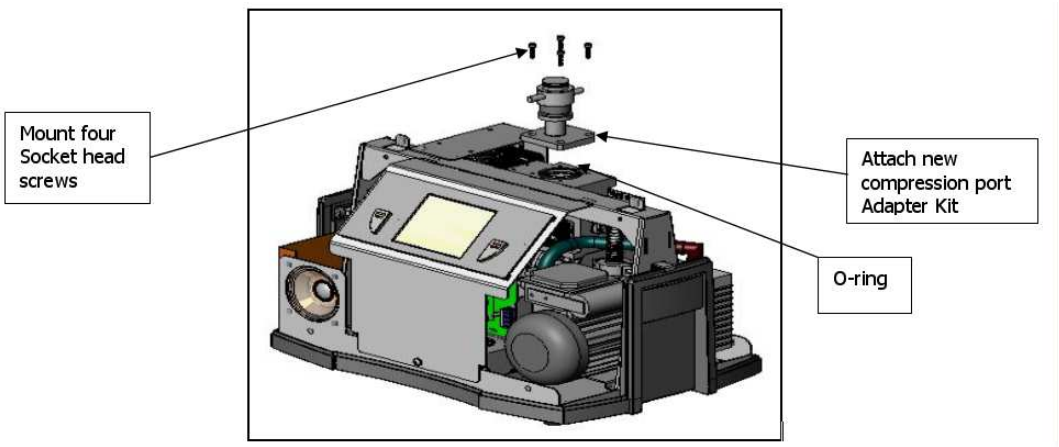

Figure 12-3 Compression Port Adapter Kit

7. Attach the front cover and secure to the unit using existing hardware.
8. Leak test the Compression Port Adapter to ensure a leak free joint.

9. Attach the rear cover and secure to the unit using existing hardware.
10. Connect the power cord and power up the unit.
11. Watch the home screen to verify that the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
12. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 13. Oil Mist Eliminator Installation

13.1 Installation Instructions

Equipment required:

- ❑ Oil Mist Eliminator Kit
- ❑ Adjustable Wrench
- ❑ Extended Length M5 Allen Wrench
- ❑ Adjustable Pliers

To install the unit:

1. Unplug the unit from the power source.
2. Using an extended length M5 Allen wrench remove the four screws holding the rear plastic cover.
3. Detach the rear plastic cover from the unit.
4. Disconnect the hose clamp and remove the hose from the barbed fitting.
5. Remove the elbow and reducer using an adjustable wrench (Figure 13-1).

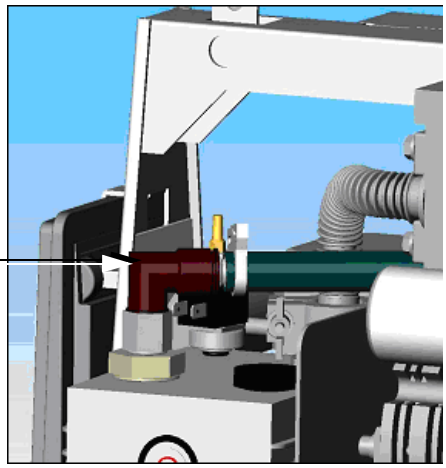

Figure 13-1 Unit Before Install

6. Clean any particles that may be present at the pump exhaust port opening.

7. Install the KF-16 flange adapter provided with the leak detector using adjustable pliers (Figure 13-2).

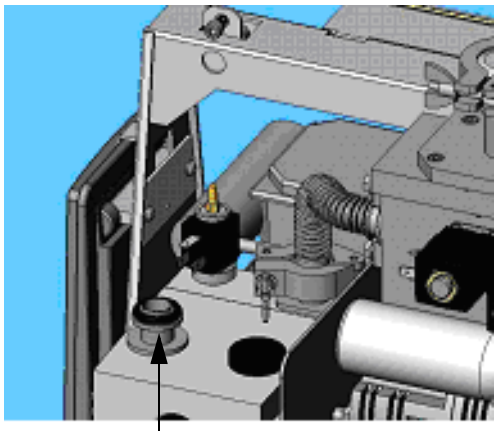

Figure 13-2 KF-16 Flange Adapter w/Centering Ring

8. Install KF-16 centering ring, the oil mist eliminator, and the KF-16 quick clamp by tightening up the wing nut.
9. Ensure the orientation of the barbed fitting as shown in Figure 13-2.
10. Reconnect the hose to the barbed fitting and secure using a hose clamp. The unit appears as in Figure 13-3.

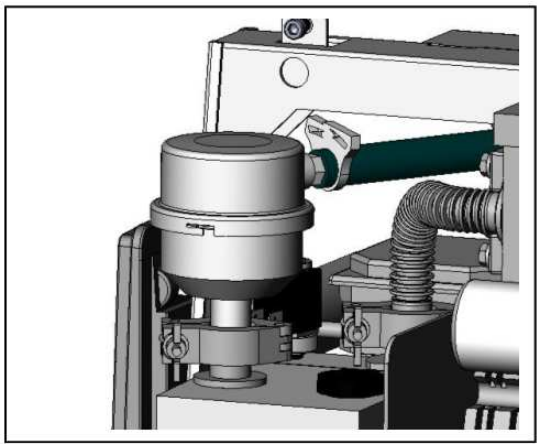

Figure 13-3 Figure 3: Oil Mist Eliminator After Install

11. Attach the rear plastic cover and secure to the unit using existing hardware.
12. Connect the power cord and power up the unit.
13. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes. Refer to the operator's manual if the system fails to reach the System Ready mode.
14. Agilent recommends a full calibration of the unit prior to leak test operations.

Section 14. Ion Source Replacement

14.1 Installation Procedure

Equipment required:

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set (Range 1.5 mm to 10 mm)
- ❑ Needle nose pliers or tweezer
- ❑ M3 Phillips Head Screw Driver
- ❑ 1.5 mm Hex Driver
- ❑ 5 mm Hex Driver
- ❑ Torque Wrench (must be adjustable to 45 in-lbs (5.0 N-m) and 90 in-lbs (10.2 N-m))
- ❑ Digital Multimeter (Fluke 187 or equivalent)

NOTE

Inspect the new ion source kit for deformation, damage and filament coating flaking prior to installation. Do not install if damaged. Touching the filament under any condition will cause damage.

For clarity, some items have been omitted from views.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 14-1 on page 14-2).

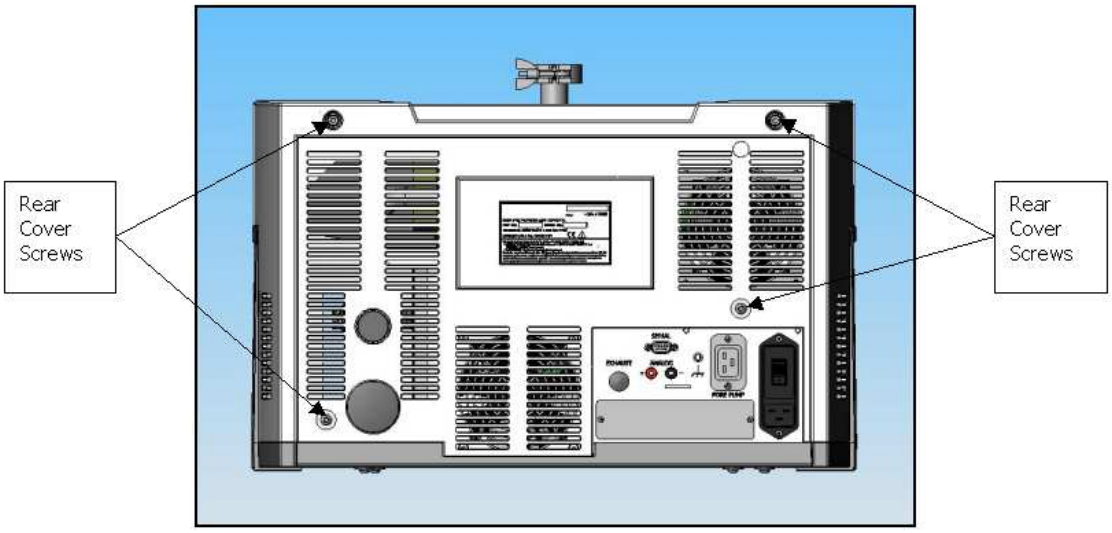

Figure 14-1 Rear Screws

4. Detach the rear plastic cover from the unit.
5. Disconnect the fan cable and remove the fan assembly by unfastening two wing nuts and one M4 socket head cap screw (Figure 14-2).

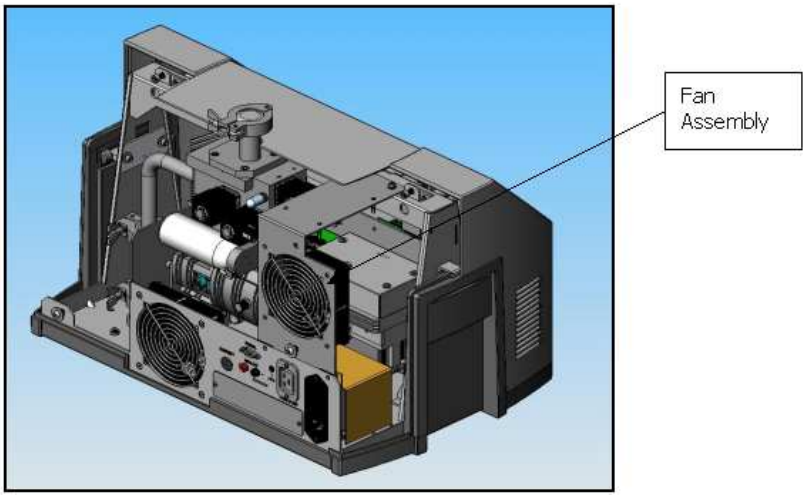

Figure 14-2 Fan Assembly

CAUTION *Static sensitive device, ensure that personnel are properly grounded before proceeding.*

6. Disconnect the spectrometer ground cable, the preamp signal cable and the ion source cable from the spectrometer (Figure 14-3).

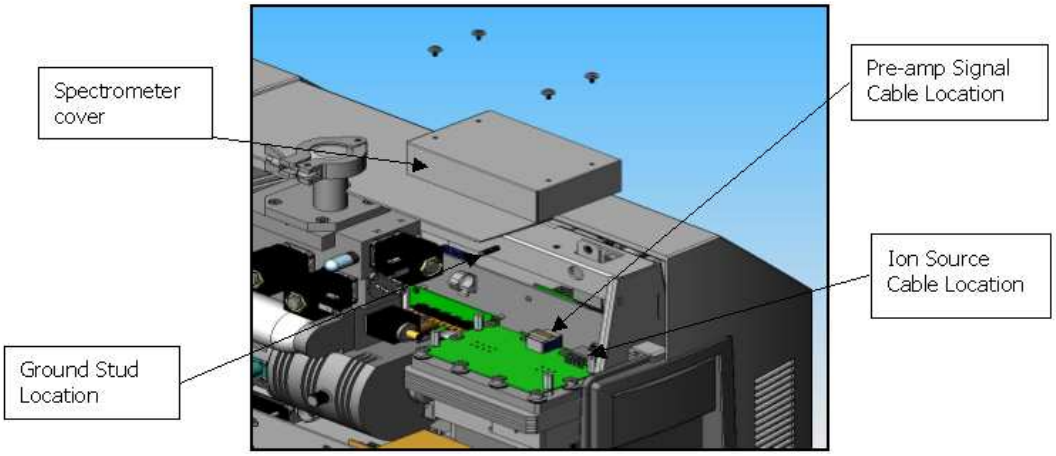

Figure 14-3 Cable Locations

NOTE *Cables not shown for clarity.*

7. Use an M3 Phillips screw driver to remove the spectrometer cover.

CAUTION *Wear non-powdered, ESD-safe Nitride or equivalent gloves (not included in kit) to prevent skin oils from getting on vacuum surfaces. Ensure that personnel are properly grounded before proceeding.*

8. Use an M5 allen wrench to loosen screws (item 1 of Figure 14-4 on page 14-4) and carefully remove the spectrometer header from the body. The vacuum system vents to atmosphere as the screws are loosened. Retain the socket head cap screws (item 1) and the Belleville washers (item 2). See Figure 14-5 on page 14-4 for correct orientation of the Belleville washers.

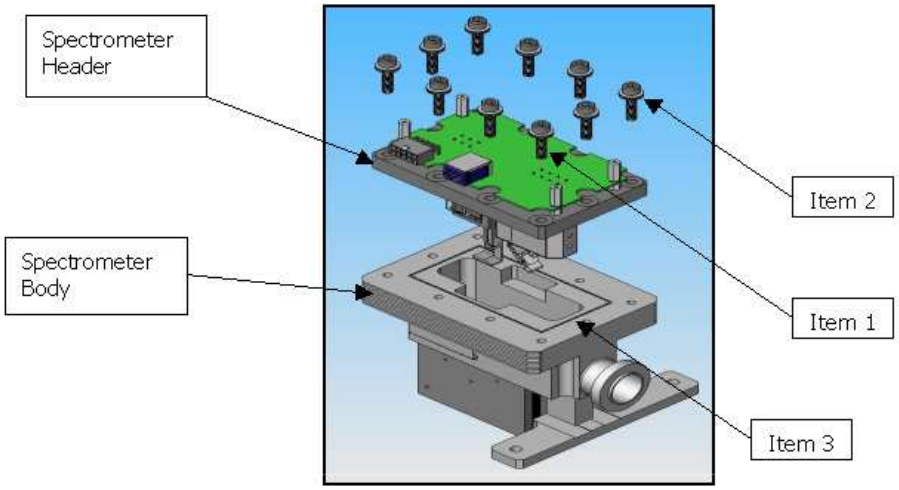

Figure 14-4 Spectrometer Exploded View

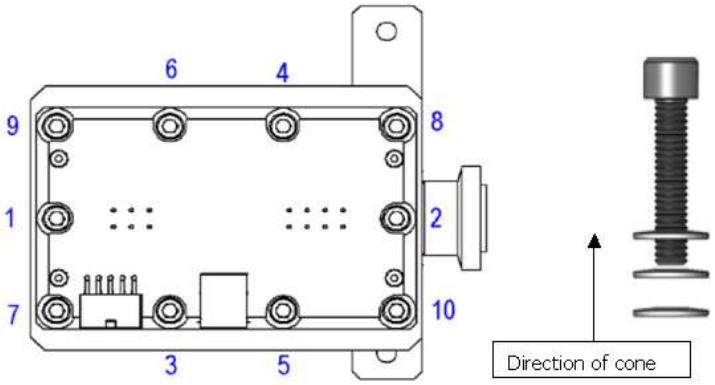

Figure 14-5 Direction of Cone

9. Remove the metal gasket (item 3) and discard. Do not scratch the mating surface when removing the gasket. Do not attempt to reuse the gasket (Figure 14-4).
10. Examine the spectrometer cavity for discolored areas. If present, refer to the service manual for cleaning instruction.

CAUTION *This is a static sensitive device, ensure that personnel are properly grounded before proceeding.*

11. Use an M1.5 Allen wrench to unscrew the six coupler screws and the collimator screw (Figure 14-6).

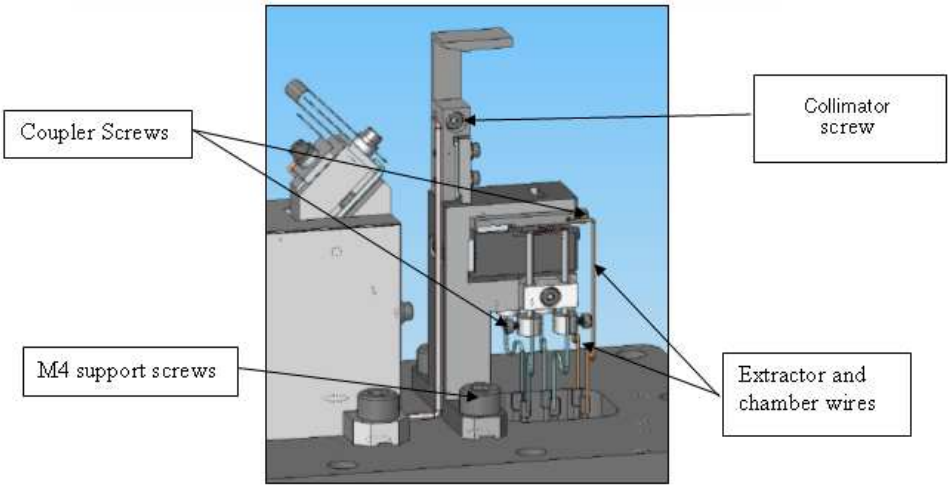

Figure 14-6 Ion Support Assembly

12. Remove the extractor, chamber and collimator wires from the assembly.
13. Remove the two M4 support screws (Figure 14-7).

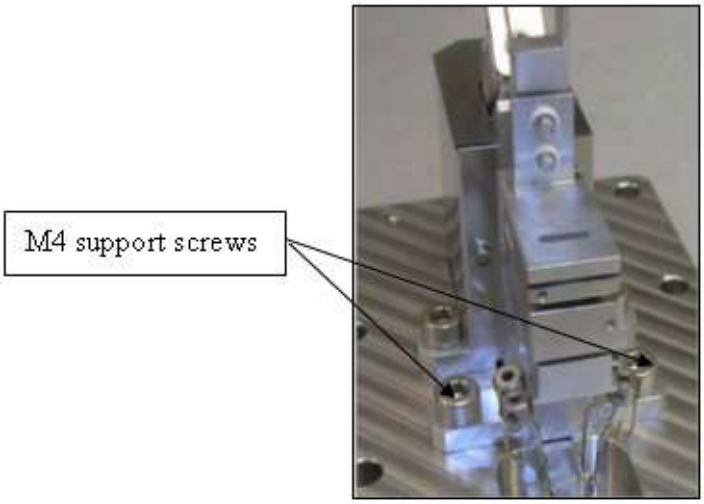

Figure 14-7 M4 Support Screws

14. Gently remove the ion support assembly from the spectrometer header.

NOTE

Ensure that no damage is done to the spectrometer wire during disassembly.

15. Position the new ion support assembly onto the spectrometer header and align.

16. Secure to the spectrometer header using two M4 support screws.
17. Connect the collimator wire to the collimator plate using an M1.5 screw (Figure 14-8).

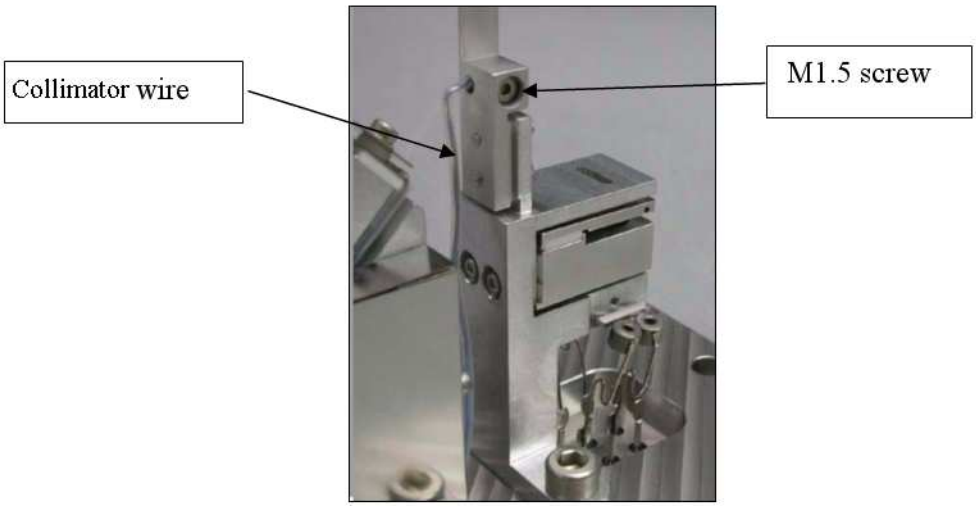

Figure 14-8 Partial Pressure Plate

18. Insert the chamber and extractor wires into the ion support assembly (Figure 14-9 and Figure 14-10).

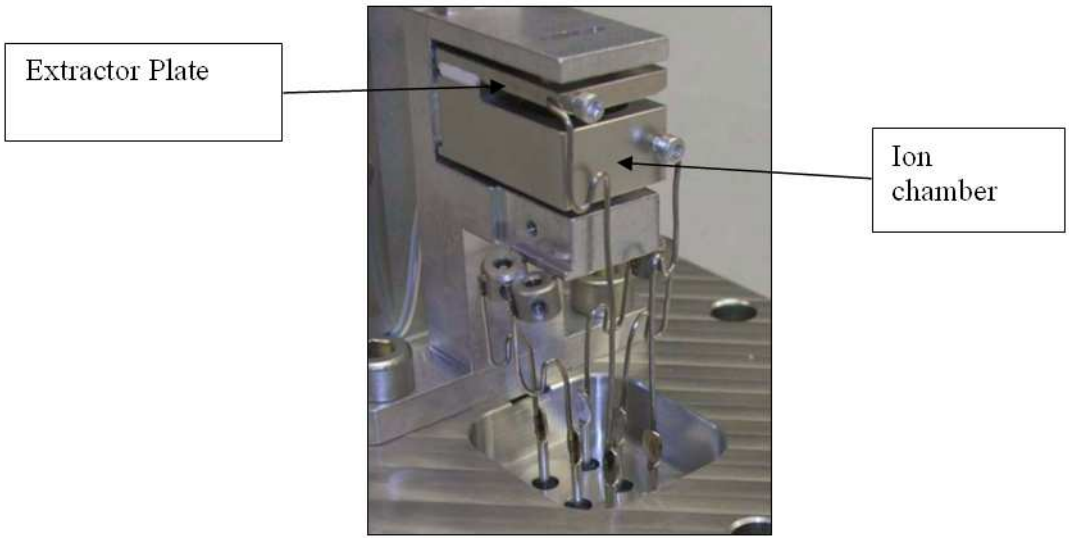

Figure 14-9 Extractor Plate

CAUTION

Do not cut the wires by over tightening. Ensure that wires are contacting the assembly where required and that no short circuit exists.

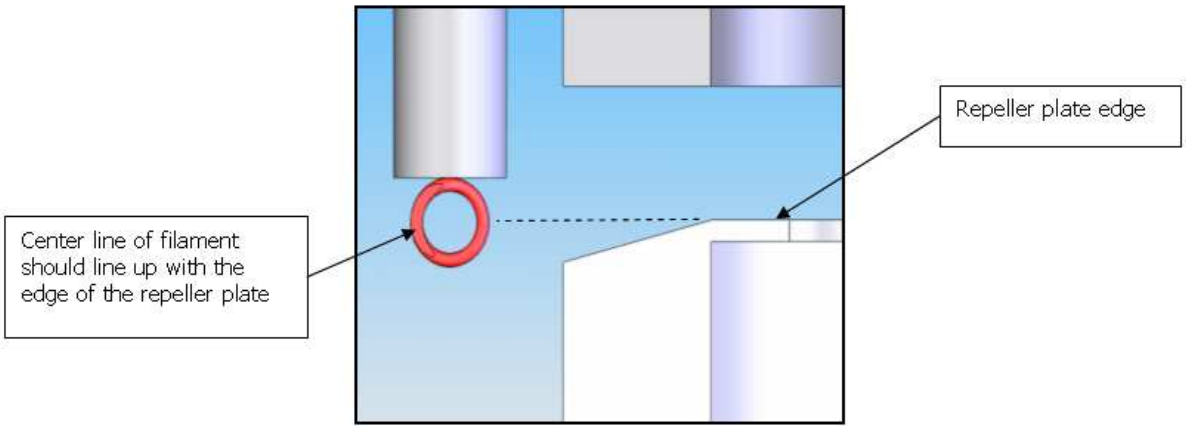

Figure 14-10 Filament Alignment

19. Insert each new filament assembly into a pair of couplers.
20. Guide the ceramic against the bottom and side ribs of the ion source support block (Figure 14-11 and Figure 14-12 on page 14-8). Correct positioning of filament is critical for proper spectrometer operation.

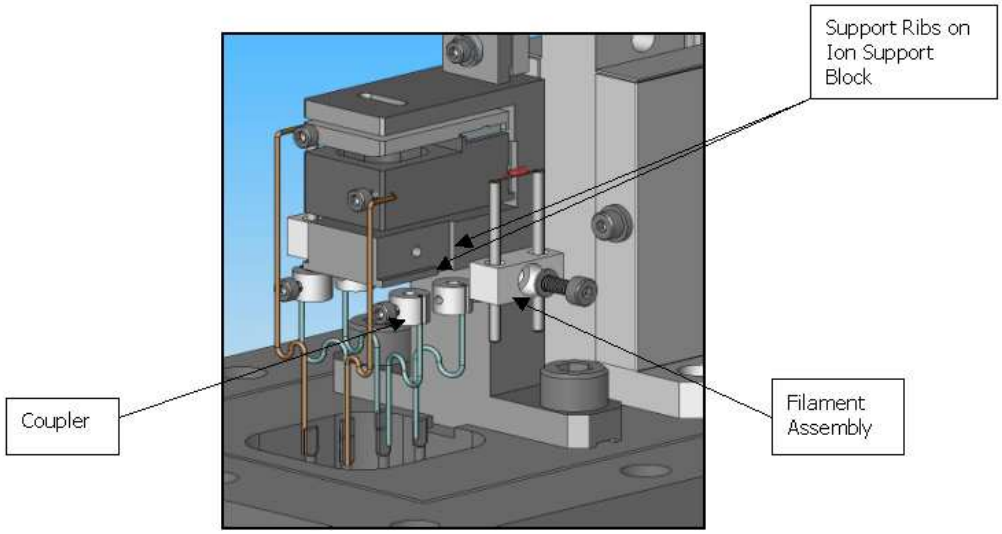

Figure 14-11 Coupler and Filament Assembly

21. While holding the filament in position, insert the M2 screw and washer and tighten (Figure 14-12).
22. Tighten the coupler screws onto the filament posts (Figure 14-12).
23. Verify ceramic is tight against the bottom and right side ribs. Ensure that the filament is positioned in the slot of the ion source as shown (Figure 14-12 and Figure 14-13 on page 14-8).

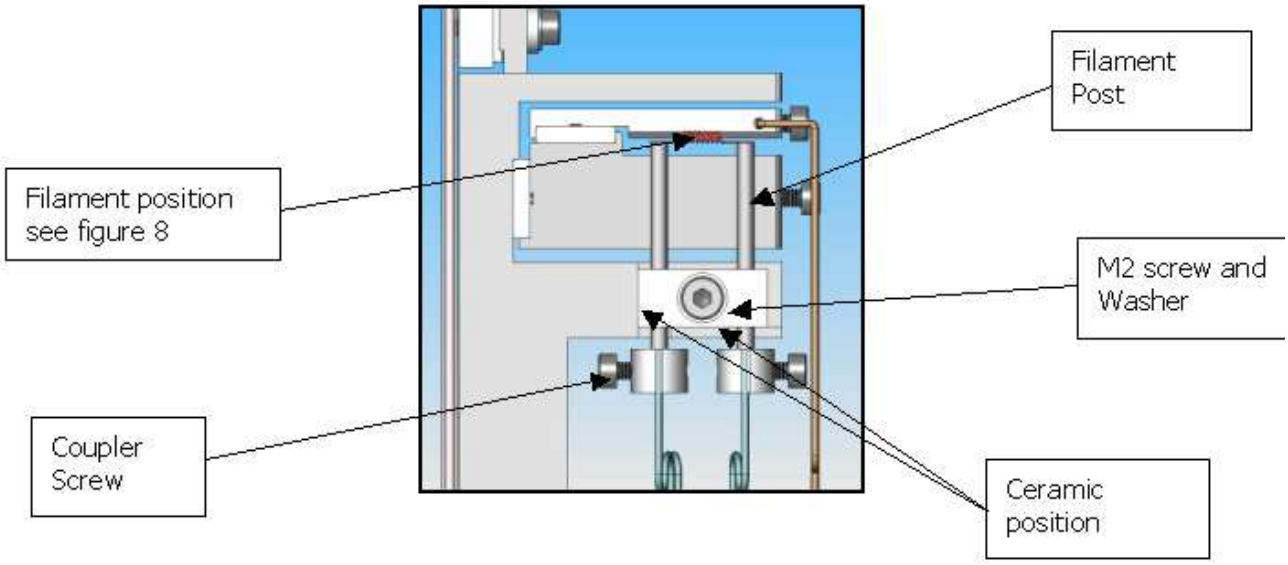

Figure 14-12 Filament Position

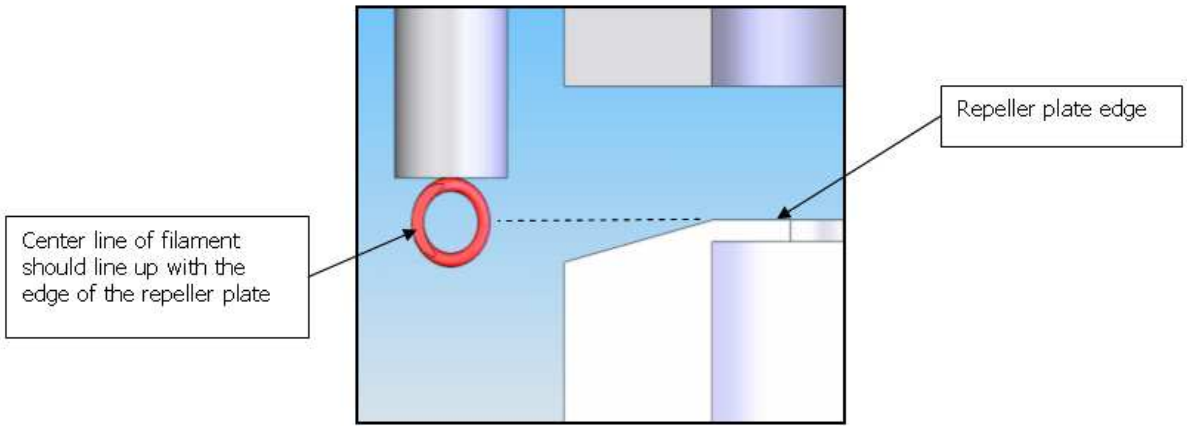

Figure 14-13 Filament Alignment

24. Clean the mating surfaces of the spectrometer body and header with Isopropyl alcohol and a clean lint free wipe.

NOTE

Agilent recommends that you use the Vac-U-Solv spectrometer cleaning kit (PN: 670029096).

25. Center replacement metal gasket inside the bolt pattern and outside of the body cavity. To prevent scratching of any sealing surface do not use metal tools for this task.
26. Guide the spectrometer header into pocket with the detector housing closest to the inlet (Figure 14-14).

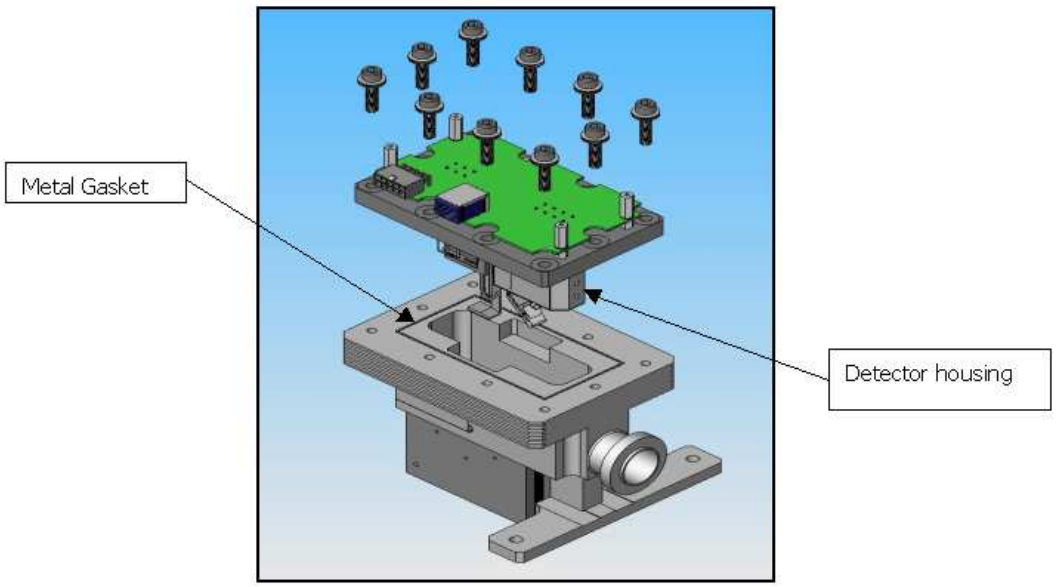

Figure 14-14 Spectrometer Alignment

27. Insert a screw with three Belleville washers into each hole and finger tighten (Figure 14-15 on page 14-10).

NOTE

The cones of the Belleville washers should all point to the head of the screw.

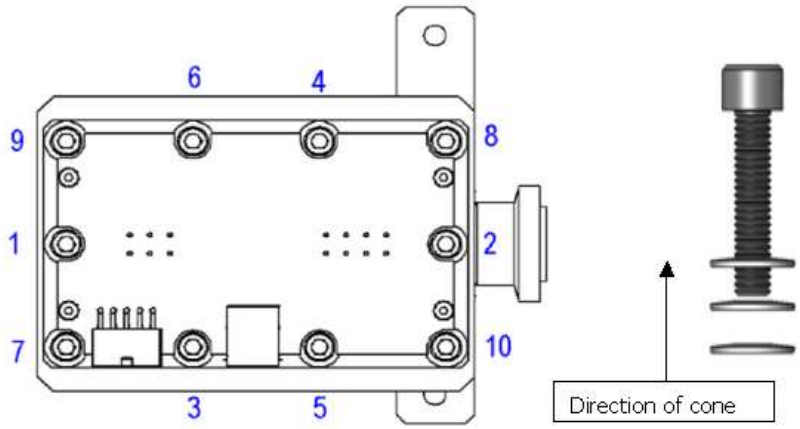

Figure 14-15 Direction of Cone

28. Following the pattern shown in Figure 14-15, torque screws to 45 in-lbs (5.0 N-m).
29. Re-torque screws to 90 in-lbs (10.2 N-m) following the same pattern. Go through the entire torque pattern twice to ensure the metal gasket is firmly compressed.
30. Wait a minimum of five minutes then torque the screws shown in pattern (Figure 14-14) to 90 in-lbs (10.2 N-m).
31. On the PCB, use the resistance meter to verify an open circuit between any two of the six ion source header pins (except FIL-1 to FIL-1 and FIL-2 to FIL-2 which should be 0.3 Ohms or less). Also verify an open circuit between the body of the spectrometer and any of the ion source header pins (Figure 14-16).

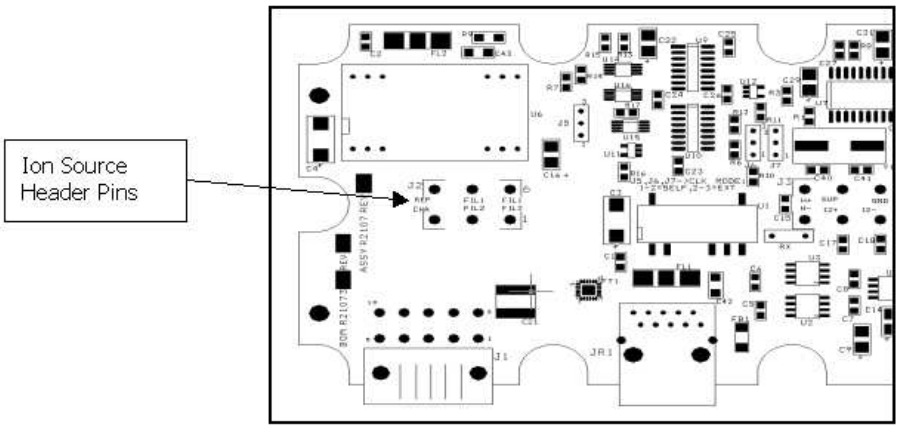

Figure 14-16 Ion Source Header Pin Schematic

If there is continuity (short circuit) at any of the points, remove the header and inspect for shorting.

32. Place the spectrometer cover over the header and align the holes (Figure 14-17).

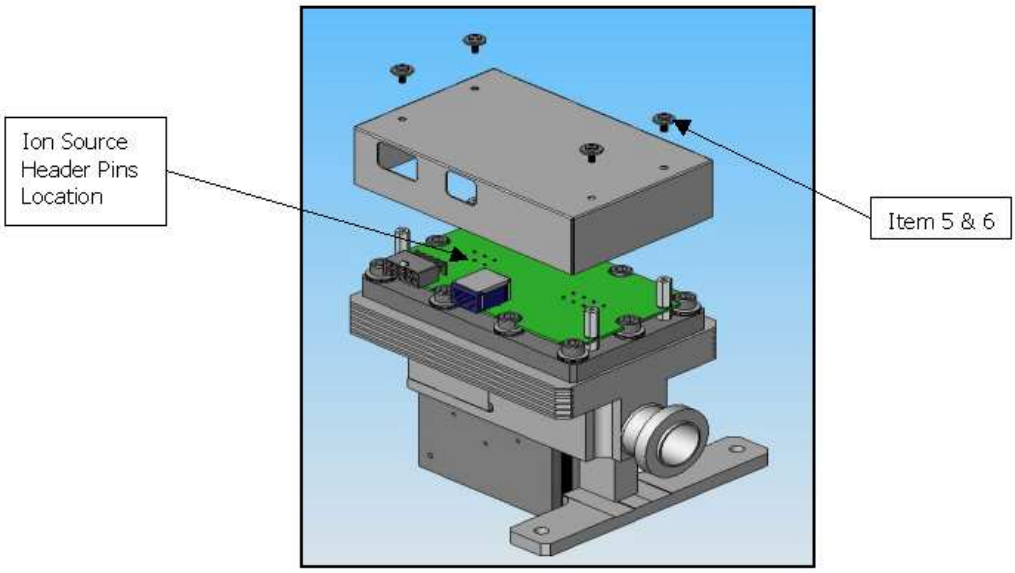

Figure 14-17 Ion Source Header Pin Locations

33. Install screws and washers (items 5 & 6), then tighten using a M3 Phillips screw driver (Figure 14-17).
34. Connect the spectrometer ground cable, the preamp signal cable and the ion source cable to the spectrometer cover.
35. Ensure that the vent valve on the turbo molecular pump (if installed) is tightened (Figure 14-18).

NOTE *The vent valve is not installed on most turbo pumps.*

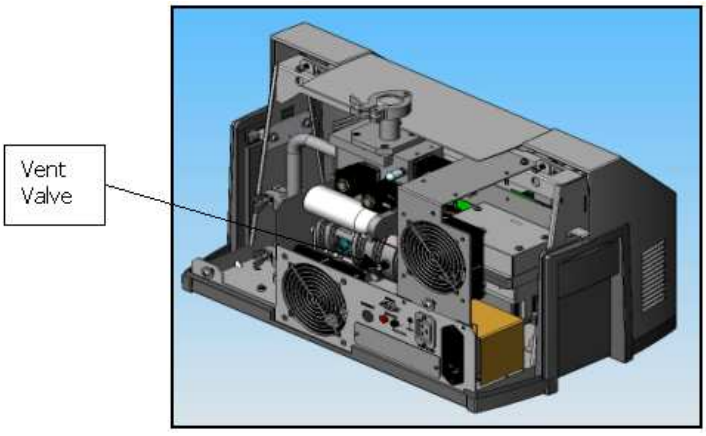

Figure 14-18 Vent Valve

36. Attach the fan assembly (Figure 14-2 on page 14-2) by fastening two wing nuts and one M4 socket head cap screw. Then connect the fan cable to the unit.
37. Leak check the spectrometer to ensure a leak free joint.
38. Attach the rear cover and secure to the unit using existing hardware.
39. Power up the unit.
40. Watch the Home screen to verify that the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes. Refer to the user manual if the system fails to reach the *System Ready* mode.

    The filament emission current normally operates at 0.8mA.
41. Use the display menus (MENUS, SET-UP, MANUAL TUNING, EMISSION) to set the emission to .8 mA.

NOTE

Agilent recommends that you wait a minimum of 30 minutes for the vacuum system to clean up to obtain optimum calibration.

42. Calibrate the system per the user manual. For proper operation the system must be calibrated after opening the spectrometer or changing a filament.
43. If the system fails calibration, adjust the filament emission current as follows:
    - ❑ If gain is too low, there is too much signal; reduce emission current (by 0.1 - 0.2mA), then calibrate again.
    - ❑ If gain is too high, there is too little signal; increase emission, then calibrate again.

    The permitted emission current range is from 0.5 to 1.5 mA.

    When calibration is successful, filament replacement is complete.

Section 15. Flapper Box Installation

15.1 Installation Procedure

Equipment Required:

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ Flapper box kit, P/N VSFLDFBCP for leak detectors with Compression Port adapter installed.
- ❑ Flapper box kit, P/N VSFLDFBNW25 for leak detectors with NW-25 Flange

NOTE

To operate the Flapper Box the leak detector must have CPU software LD02.11 or greater. If correct software is not installed, contact Agilent Customer Service.

For clarity, some items have been omitted from views.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 15-1) and detach the rear plastic cover from the unit.
4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 15-1).

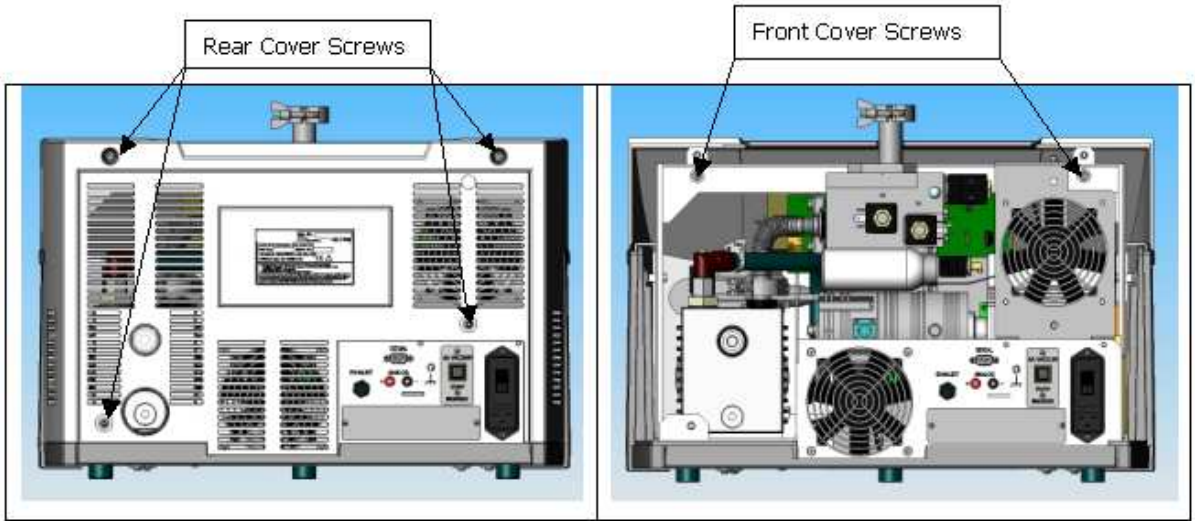

Figure 15-1 Rear and Front Cover Screws

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

5. Remove the two wing nuts holding the plastic shield around the leak detector power input area and remove the shield (Figure 15-2).
6. Remove the fan assembly by loosening the M4 socket head cap screw (Figure 15-2).

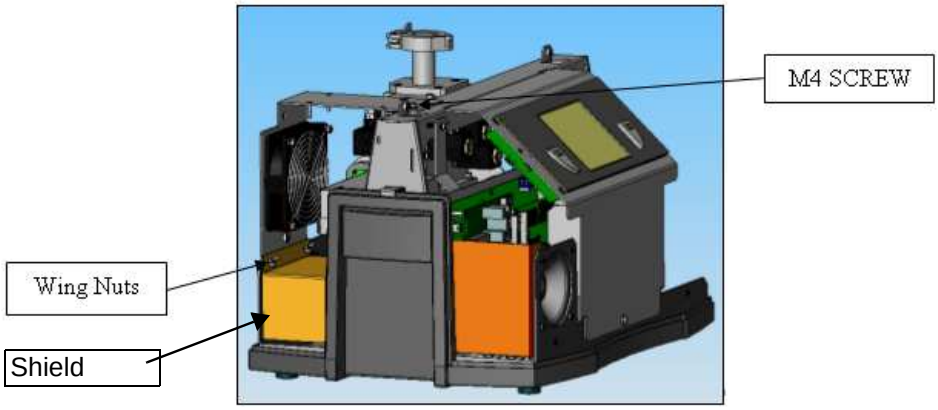

Figure 15-2 Plastic Shield

CAUTION *Use proper ESD safety techniques when handling a PCB card.*

7. Remove the two I/O board Phillips head screws w/lock washers and remove the I/O board that is installed in the unit (Figure 15-3).
8. Slide the I/O assembly back to allow room to connect the flapper box wiring harness to the I/O board.

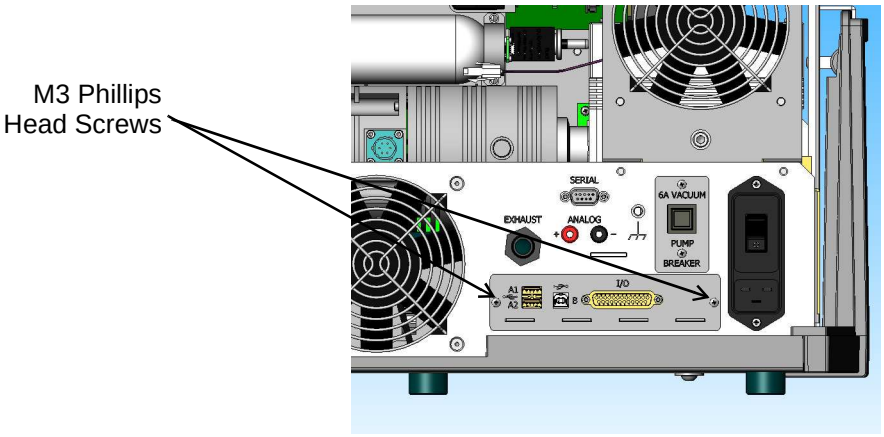

Figure 15-3 I/O Assembly with Screws

9. Connect the *P102* Molex receptacle on the flapper box wire harness to the *J102* connector on the I/O board (Figure 15-4).

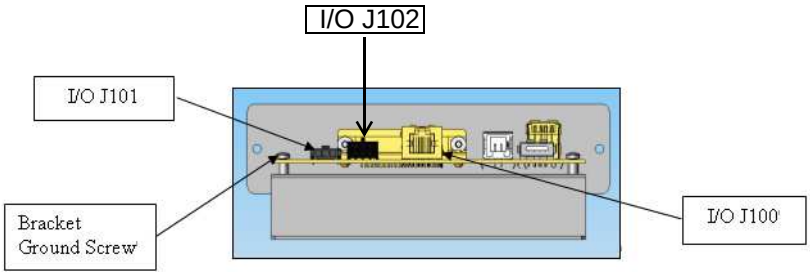

Figure 15-4 I/O Bracket

10. Slide the I/O assembly into the leak detector and ensure that the I/O bracket engages the clip at the base of the leak detector (Figure 15-5).
11. Reinstall the two I/O board Philips head screws w/lock washers (Figure 15-3 on page 15-2).

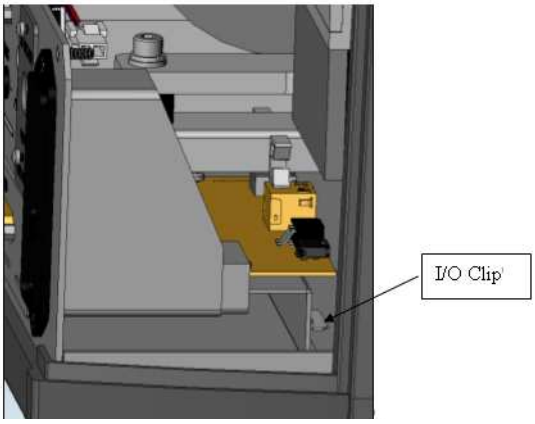

Figure 15-5 I/O Clip

12. Remove M4 screw (Figure 15-6) and open front panel to provide required room for installing the Flapper Box Wiring harness.

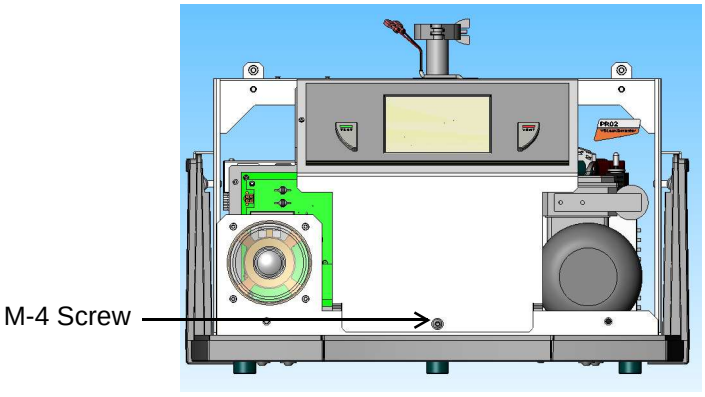

Figure 15-6 Front Panel Removal

13. Remove the M4 screws (Figure 15-7) and gently lean the PCB Mounting Tray forward to gain access to the Flapper Box Wiring Harness.

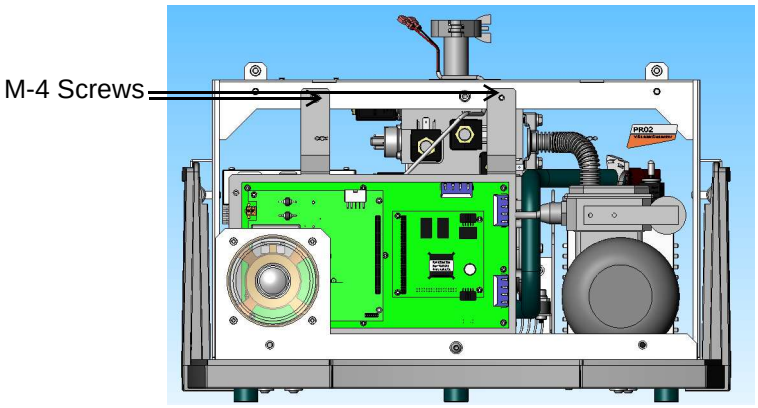

Figure 15-7 PCB Mounting Tray

14. Install the Flapper Box Wiring Harness, as shown (Figure 15-8), utilizing the top two wire clips, only use bottom wire clip, if accessible.

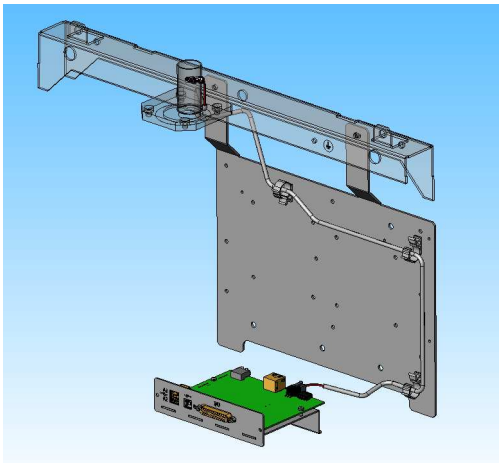

Figure 15-8 Flapper Box Wiring Harness Layout

15. Reinstall the M4 screws (Figure 15-7).
16. Reinstall the M4 screw (Figure 15-6 on page 15-3).
17. Reinstall the (Figure 15-2 on page 15-2):
    - ❑ Fan assembly by tightening the M4 socket head screw.
    - ❑ The plastic shield using the two wing nuts.
18. Attach the front cover and secure to the frame using existing hardware.

19. Carefully locate the Flapper Box Wire Harness leads between the front cover and the test port (Figure 15-9).
20. Attach the rear cover and secure the unit using existing hardware.

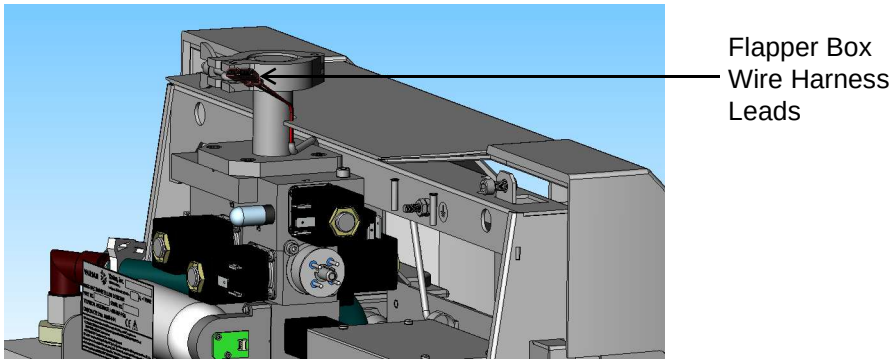

Figure 15-9 Front Cover Assembly

21. Install the flapper box for:
    - ❑ P/N VSFLDFBNW25: Utilizing the NW-25 Centering Ring and Quick Clamp (Figure 15-10).
    - ❑ P/N VSFLDFBCP: Inserting the Flapper Box into leak detector's Compression Port Adapter and tighten.
22. Connect the leads of the Flapper Box to the leads of the Wire Harness: Red to Red and Black to Black.

Figure 15-10 Flapper Box Assembly, NW25 Installation

23. Connect the power cord and power up the unit.
24. Watch the home screen to verify that the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

Refer to the operator's manual if the system fails to reach the *System Ready* mode.

25. Manually close the flapper box, the leak detector should transfer into test.
26. After 30 seconds verify that the vent button is operational (the flapper box should open).
27. Agilent recommends a full calibration of the unit prior to leak test operations.

Section 16. I/O Card Installation

16.1 Installation Procedure

16.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver

For clarity, some items have been omitted from views.

WARNING

Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.

NOTE

Prior to I/O installation, ensure that the software revision is 2.0 by navigating from the Home screen menu to System Information. If not, contact Agilent customer services, see the back cover of this manual for a listing of our sales and service offices.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 16-1 on page 16-2) and detach the rear plastic cover from the unit.

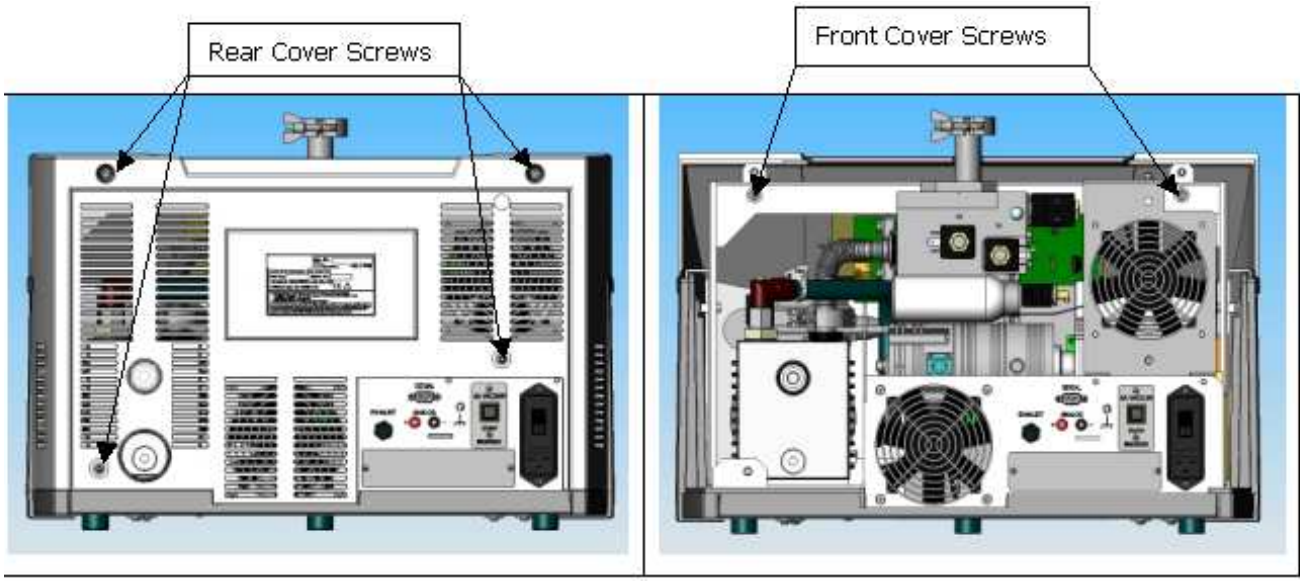

Figure 16-1 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 16-1).
5. Remove the two back plate Phillips head screws w/lock washers (Figure 16-2) and pull the blank back plate off and discard.

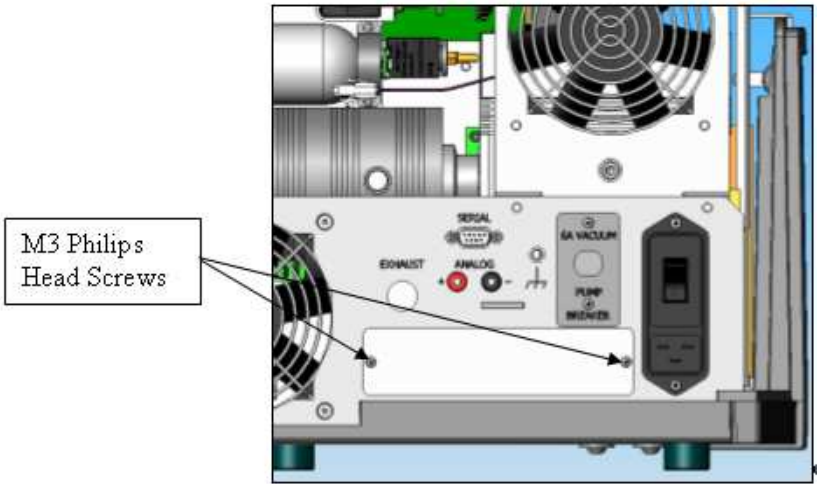

Figure 16-2 Back Plate with Screws

6. Remove the two wing nuts holding the plastic shield around the power input area inside the leak detector and remove the shield (Figure 16-3).

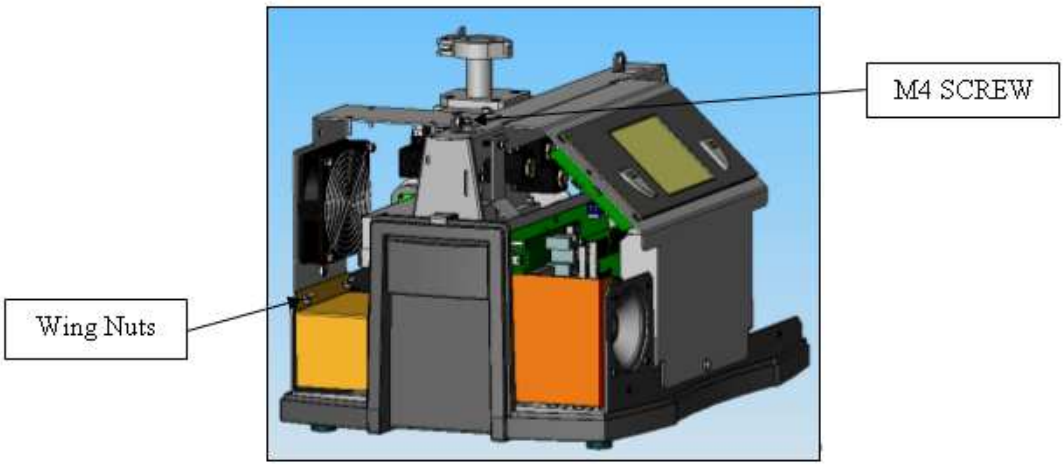

Figure 16-3 Plastic Shield

7. Remove the fan assembly by loosening the M4 socket head cap screw (Figure 16-3).

CAUTION *Use proper ESD safety techniques when performing a PCB card install.*

8. Connect the I/O cable end labeled P100B, provided with the kit, to J100 (marked Yellow) on the mother board PCB (Figure 16-4). Then run the cable along the base of the leak detector to the I/O board location.

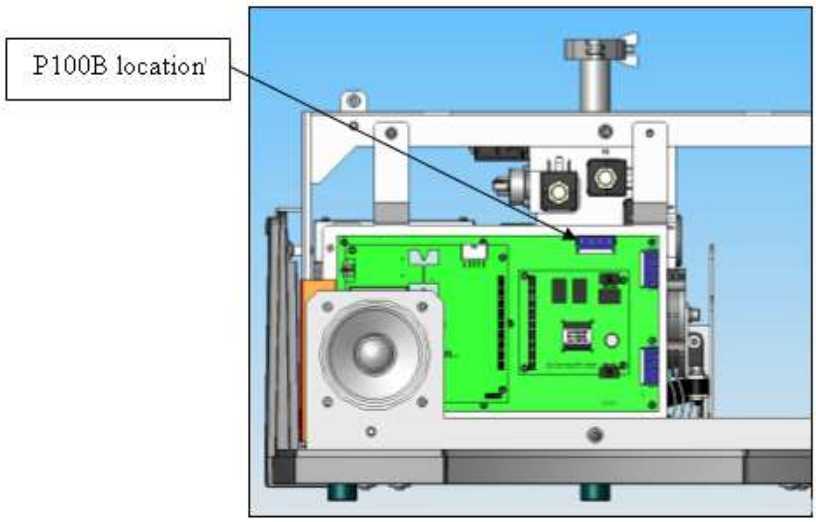

Figure 16-4 I/O Cable to Mother Board

9. Rotate the I/O bracket and board to approximately a 30° angle and insert into the leak detector (Figure 16-5).

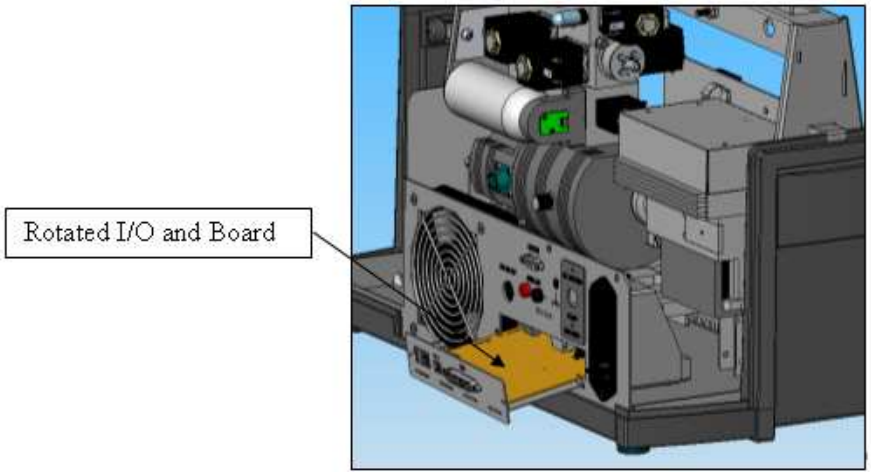

Figure 16-5 I/O Bracket Installation

10. Connect the (Figure 16-6):
    - ❑ Opposite end of the cable labeled P1 to J100 on the I/O board.
    - ❑ 24 V plug labeled P101, which is tie rapped at the base of the leak detector, to the connector labeled J101 on the I/O board.
    - ❑ 24 V lug as a ground to one of the bracket screws.

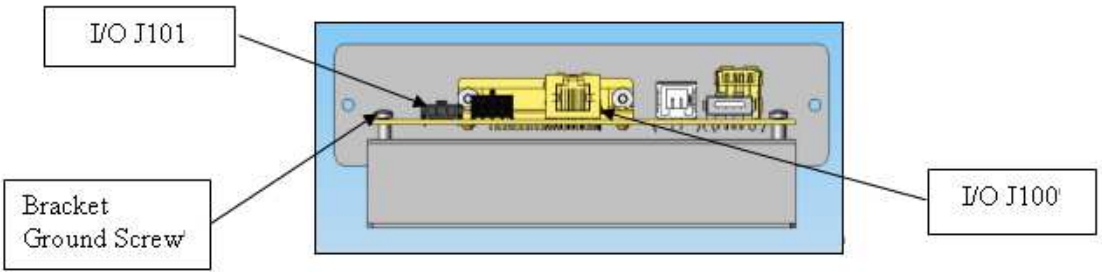

Figure 16-6 I/O Bracket

11. Slide the I/O assembly into the leak detector and ensure that the I/O bracket engages the clip at the base of the leak detector (Figure 16-7).

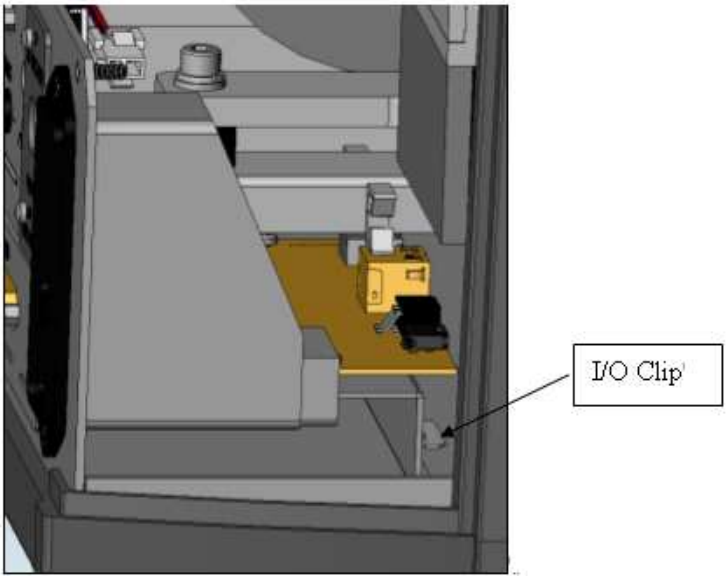

Figure 16-7 I/O Clip

12. Reinstall the two back plate Phillips head screws w/lock washers (Figure 16-2 on page 16-2).
13. Reinstall the (Figure 16-3 on page 16-3):
    - ❑ Fan assembly by tightening the M4 socket head screw.
    - ❑ Reinstall the plastic shield using the two wing nuts.
14. Attach the front cover and secure to the frame using existing hardware.
15. Attach the rear cover and secure to the frame using existing hardware.
16. Connect the power cord and power up the unit.
17. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes. Refer to the operator's manual if the system fails to reach the System Ready mode.
18. Agilent recommends a full calibration of the unit prior to leak test operations.
19. Connect operators 25-pin cable to the I/O connector and verify the connection. Refer to Section A.3 of the users manual for the I/O pin connector signals.

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Section 17. Wireless Remote Base Unit Installation

17.1 Installation Procedure

17.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver
- ❑ Adjustable Wrench

For clarity, some items have been omitted from views.

WARNING

Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.

NOTE

Prior to I/O installation, ensure that the software revision is 2.0 by navigating from the Home screen menu to System Information. If not, contact Agilent customer services, see the back cover of this manual for a listing of our sales and service offices.

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 17-1) and detach the rear plastic cover from the unit.

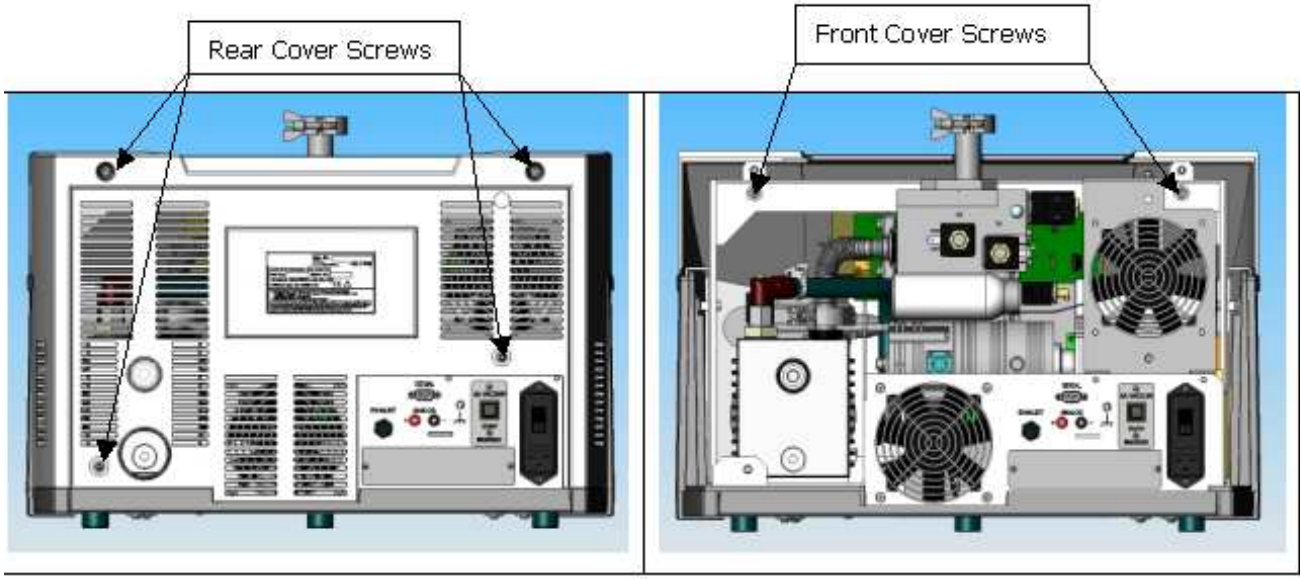

Figure 17-1 Rear and Front Cover Screws

4. Remove the four screws holding the front plastic cover and detach the cover from the unit. Two screws are situated at the front of the unit (not shown) and two screws are positioned inside the unit (Figure 17-1).
5. Disconnect the fan connector from the 24 V cable harness.
6. Detach the fan assembly by removing the M4 socket head cap screw and loosening the two wing nuts (Figure 17-2). Place the fan assembly on a flat surface on its back.

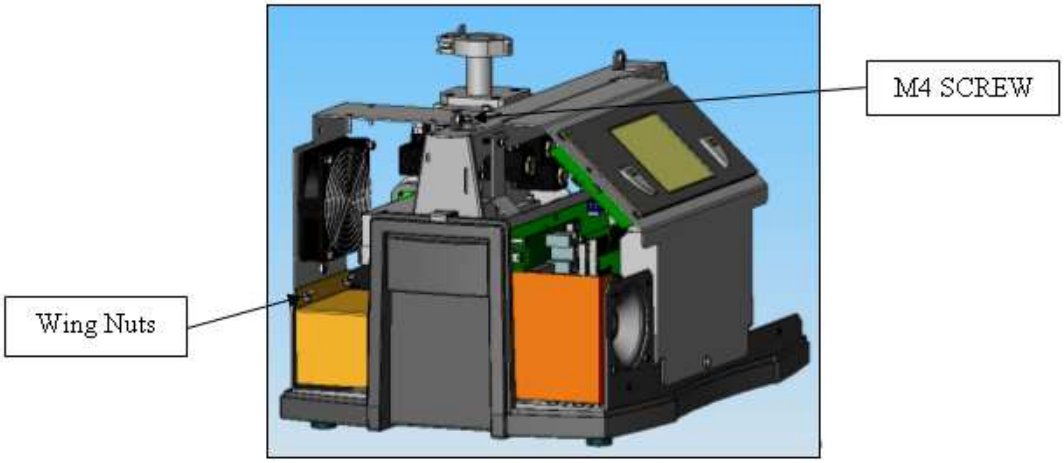

Figure 17-2 Fan Assembly and Socket Head Cap Screw

7. Hand tighten the antenna to the fan bracket, and then apply a ½ turn using an adjustable wrench (Figure 17-3).

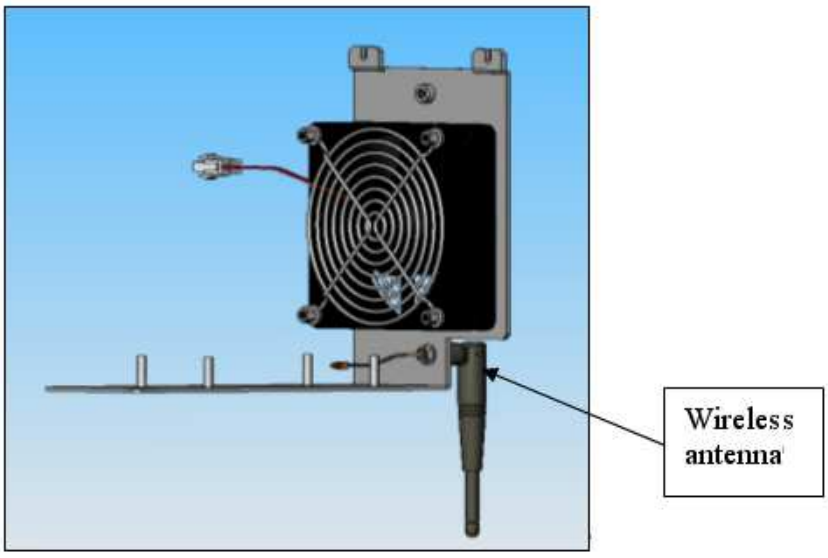

Figure 17-3 Wireless Antenna

CAUTION *Use proper ESD safety techniques when performing a PCB card install.*

8. Place the wireless board assembly on the four fan bracket standoffs. Note the correct orientation of the wireless base board P300 connector (Figure 17-4).

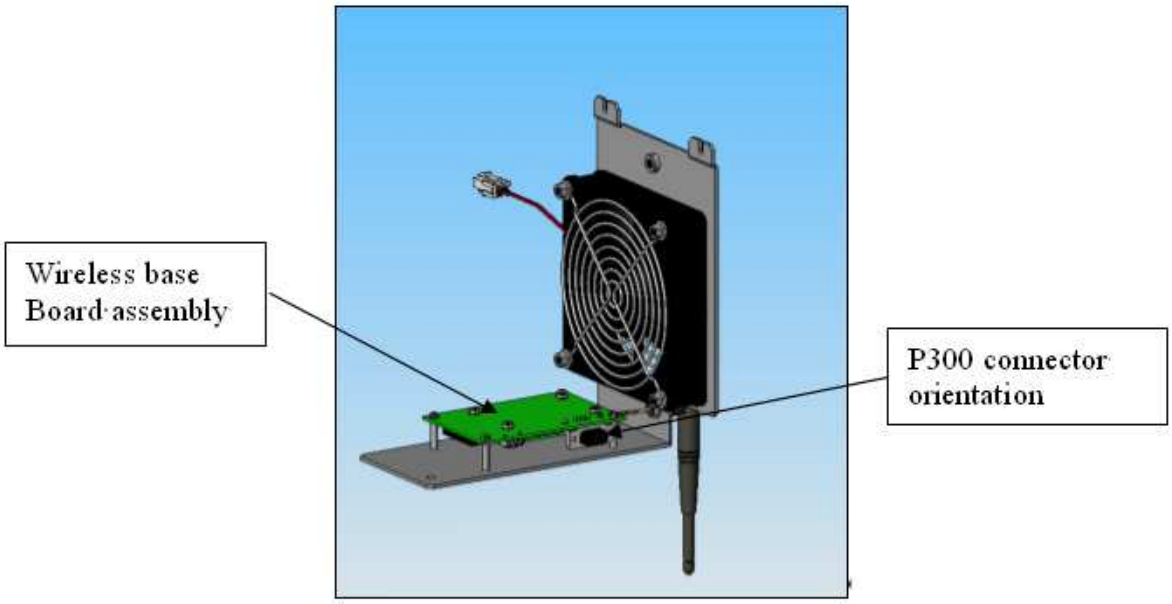

Figure 17-4 Base Board Assembly with Posts

9. Connect the antenna cable to the MMCX jack (Color: gold) on the wireless base board.
10. Secure the wireless base board to the fan bracket using the four M3 Phillips screws provided with the kit.
11. Unfurl the black/red wire (P1-RF) with the 24 V three-pin connector and the ground lug, which is tie rapped at the base of the leak detector, and:
    - ❑ Plug the 24 V connector labeled P1-RF into the three-pin connector on the wireless board.
    - ❑ Attach the 24 V ground lug to one of the bracket screws.
    - ❑ Reinstall the fan assembly by tightening the M4 socket head cap screw and the two wing nuts (Figure 17-2 on page 17-2).
12. Connect the RS-232 cable end labeled J300-1 to P300 on the wireless board using its two slotted screws (Figure 17-4 on page 17-3).
13. Dress the RS-232 cable through the leak detector to the front panel display.
14. Remove the M6 screw and washer from the front panel display and detach the display (Figure 17-5).

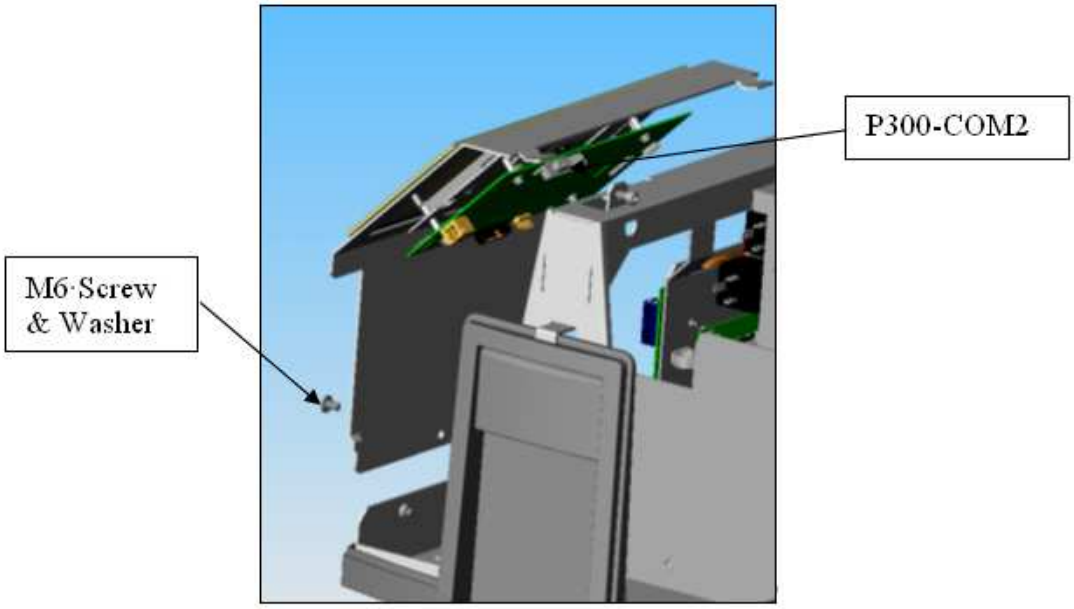

Figure 17-5 Front Panel Display

15. Connect the RS-232 cable end labeled J300-2 to P300-COM2 on the front panel display board using its two slotted screws (Figure 17-5).
16. Reattach the display by inserting the tabs into their slotted positions and secure using the M6 screw and washer.
17. Attach the front cover and secure to the frame using existing hardware.

18. Rotate the antenna to its horizontal locked position.
19. Guide the antenna through its location hole in the rear cover. Then secure the rear cover to the frame using existing hardware.
20. Attach the label to the rear cover in location shown (Figure 17-6).

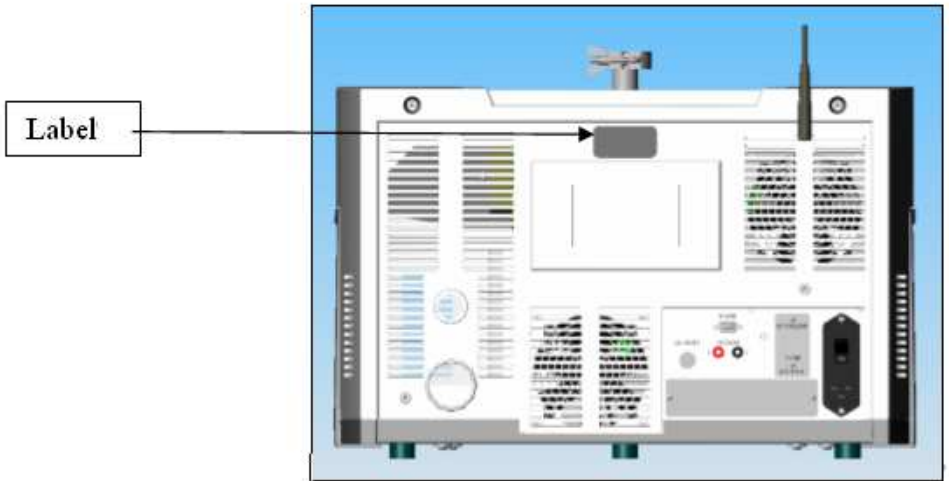

Figure 17-6 Label

21. Connect the power cord and power up the unit.
22. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
23. After installation refer to the VS Series leak detector manual (P/N # 699909942) Section 3, for leak detector activation of the wireless remote.
24. Refer to the wireless remote user's manual (P/N # 699909945) for operational instructions.
25. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 18. Scroll Pump Replacement (PD03 only)

18.1 Installation Procedure

18.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 18-1) and detach the rear plastic cover from the unit.

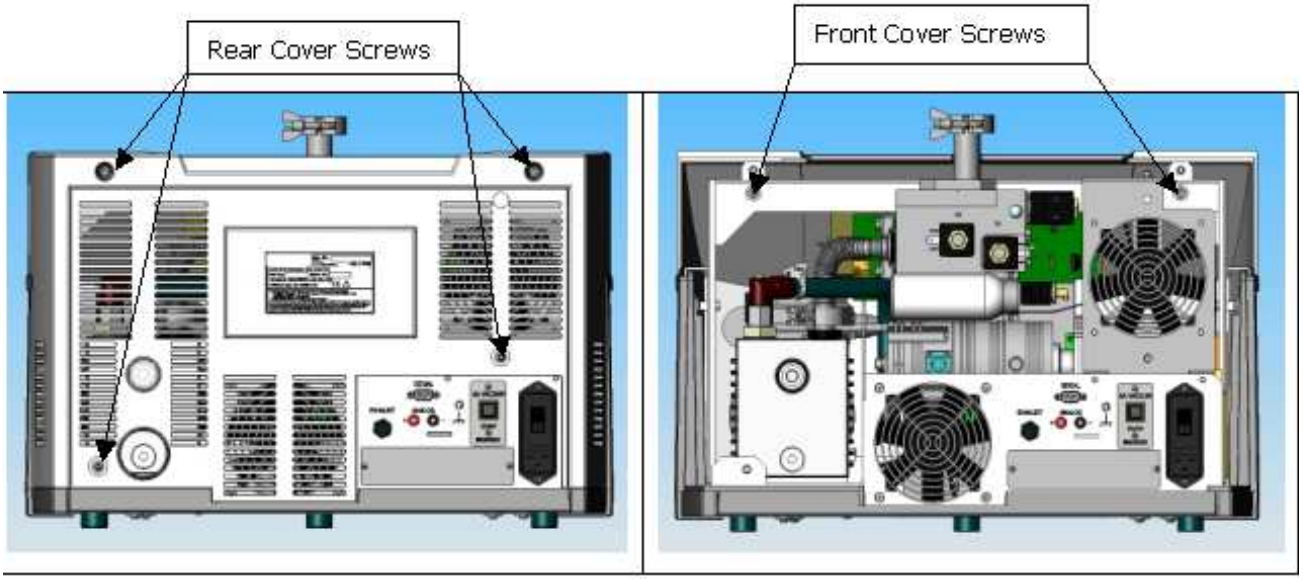

Figure 18-1 Rear and Front Cover Screws

4. Disconnect the NW 16 connection (Figure 18-2).

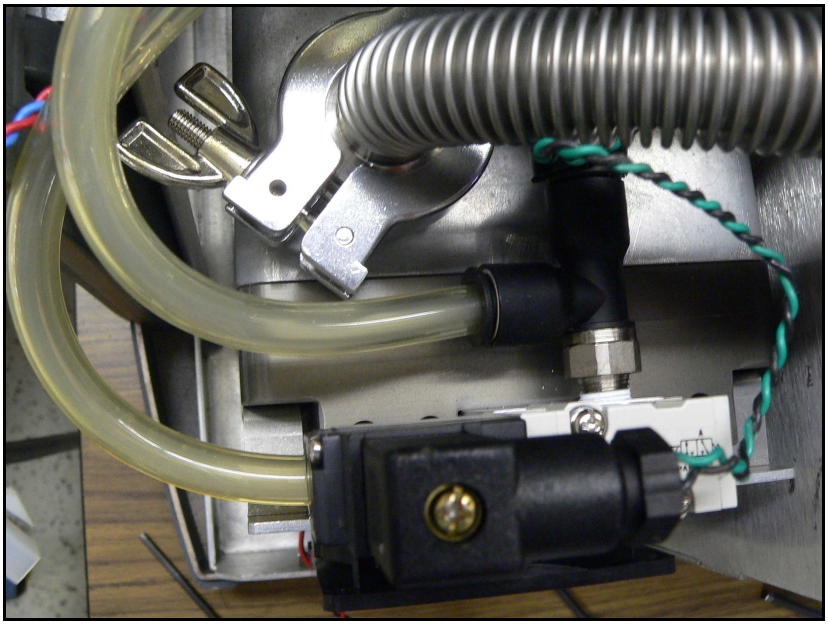

Figure 18-2 NW 16 Connection

5. Tilt the unit and unscrew the four connections underneath that hold the pump (Figure 18-3). Place the unit flat again and remove the whole pump assembly.

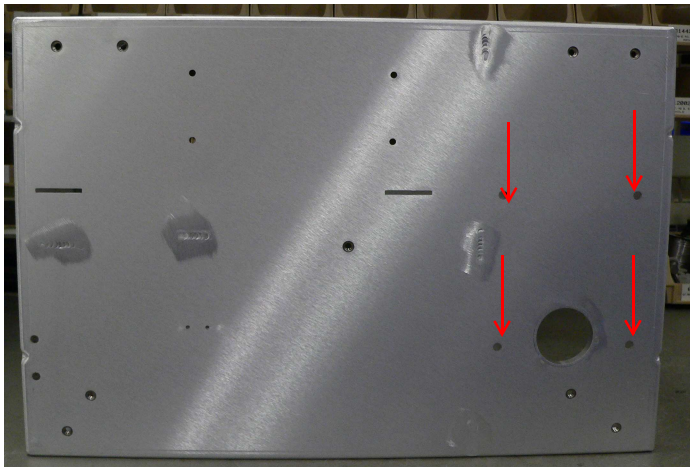

Figure 18-3 Scroll Pump Mounting Connections

6. Disconnect the exhaust hose (Figure 18-4).

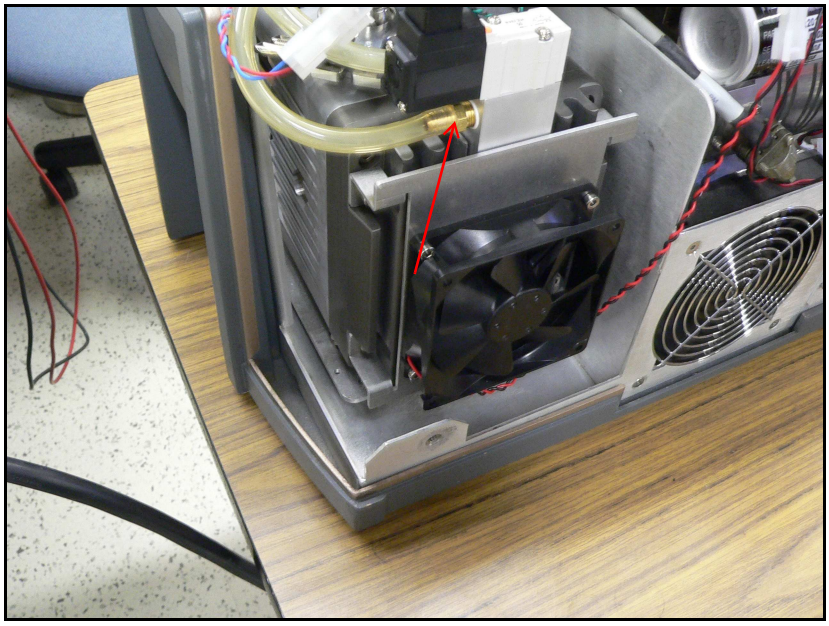

Figure 18-4 Exhaust Hose

7. Disconnect the diaphragm, fan and motor power connectors.
8. Remove the fan assembly bracket and lay it aside (Figure 18-5).

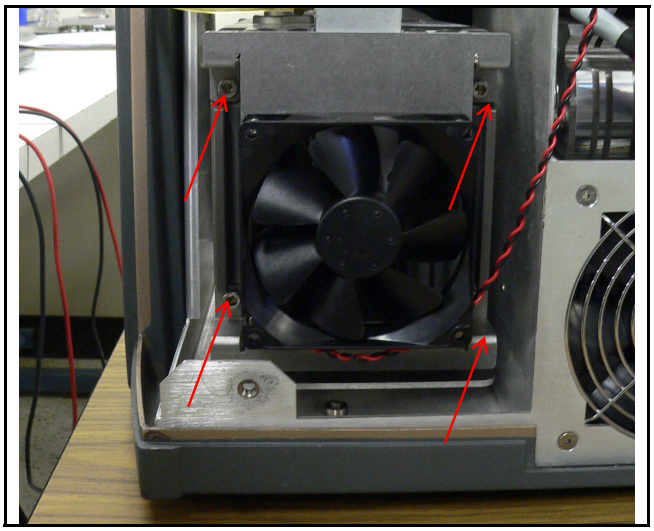

Figure 18-5 Fan Assembly Mounts

9. Unscrew the four M2 screws and remove the manifold block (Figure 18-6).

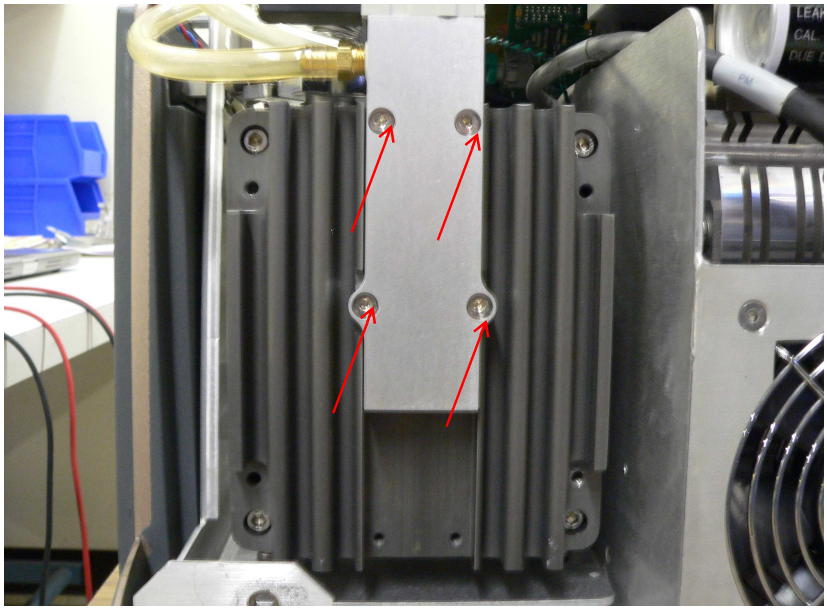

Figure 18-6 Manifold Block Connections

10. Remove the exhaust valve unit. See Section 21 “Exhaust Valve Replacement (PD03 only)” on page 21-1.
11. Remove the diaphragm pump. See Section 22 “Diaphragm Pump Replacement (PD03 only)” on page 22-1.
12. Mount the new scroll pump using the four connections seen in Figure 18-3 on page 18-2.
13. Reattach the diaphragm pump. See Section 22 “Diaphragm Pump Replacement (PD03 only)” on page 22-1.
14. Reattach the exhust valve. See Section 21 “Exhaust Valve Replacement (PD03 only)” on page 21-1.
15. Reattach the four M2 screws to remount the manifold block.
16. Reattach the fan assembly.
17. Reconnect the diaphragm, fan and motor power connectors.
18. Reconnect the exhaust hose.
19. Attach the front cover and secure to the frame using existing hardware.
20. Connect the power cord and power up the unit.
21. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
22. Agilent recommends a full calibration of the unit prior to leak test operations.

Section 19. Scroll Pump Fan Replacement (PD03 only)

19.1 Installation Procedure

19.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 19-1) and detach the rear plastic cover from the unit.

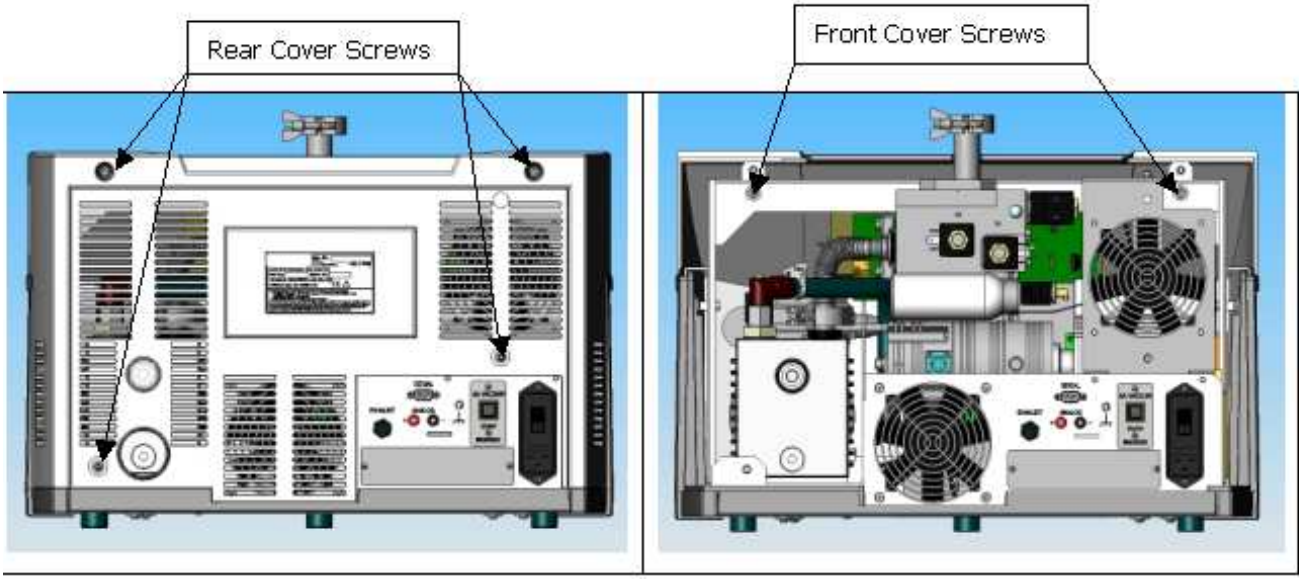

Figure 19-1 Rear and Front Cover Screws

4. Remove the four M3 screws and remove the fan (Figure 19-2).

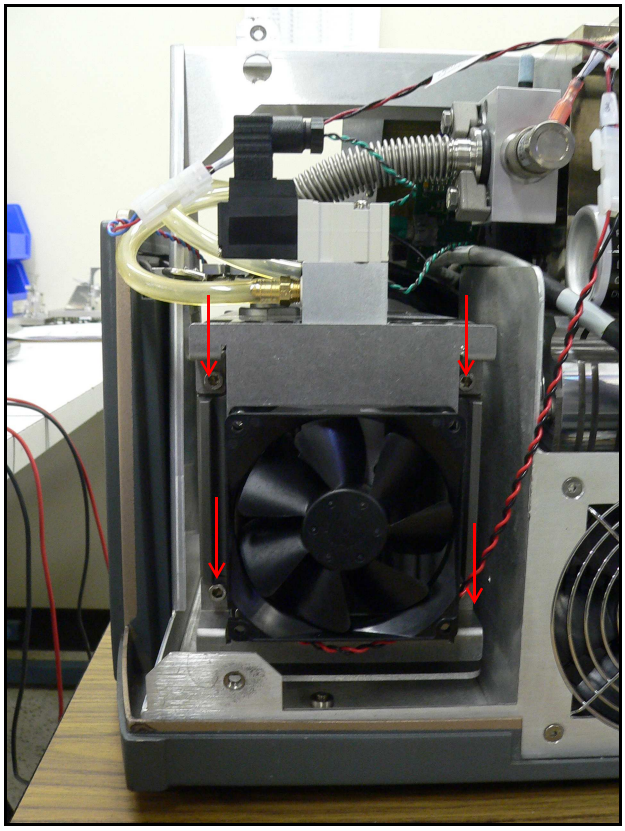

Figure 19-2 Fan Screws

5. Run the black/red connector through the slit (Figure 19-3). **Where is the power connection?**

Figure 19-3 Connector Routing

6. Install the new fan using the reserved M3 screws.
7. Attach the front cover and secure to the frame using existing hardware.
8. Attach the rear cover and secure to the unit using existing hardware.
9. Reinstall the power connector.
10. Connect the power cord and power up the unit.
11. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
12. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 20. Clippard Valve Replacement (PD03 only)

20.1 Installation Procedure

20.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 20-1) and detach the rear plastic cover from the unit.

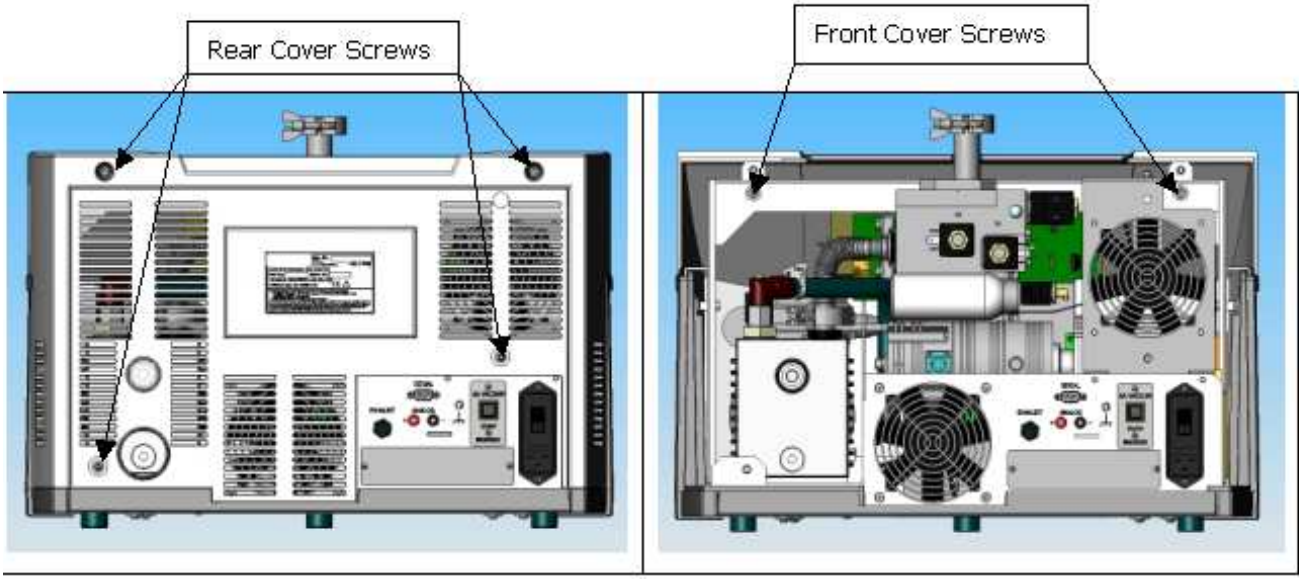

Figure 20-1 Rear and Front Cover Screws

4. Disconnect the two spade connectors (red arrow in Figure 20-2):
   - ❑ Red/black
   - ❑ Black/black

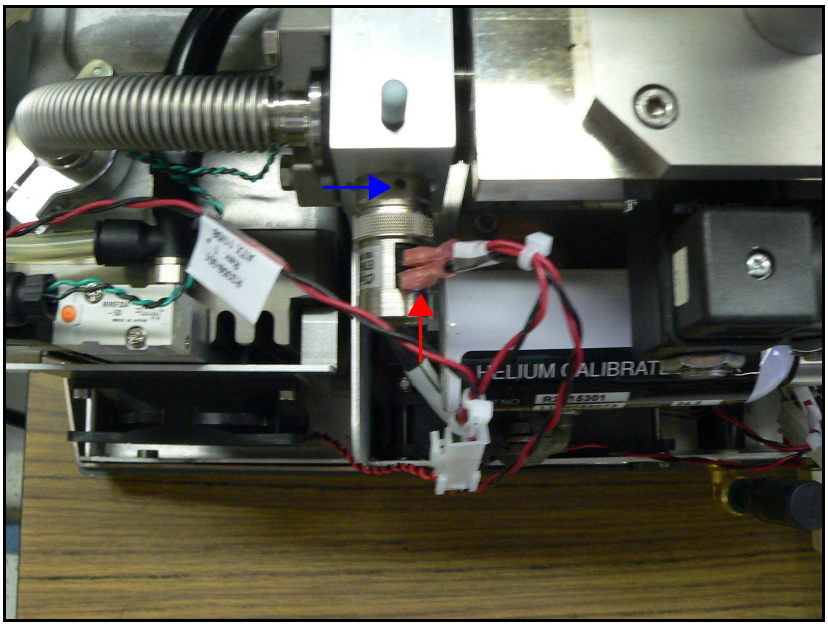

Figure 20-2 Spade Connectors

5. Use an Allen wrench to loosen valve from housing (blue arrow in Figure 20-2).
6. Mount the new valve and tighten.
7. Reconnect the two spade connections.
8. Attach the front cover and secure to the frame using existing hardware.
9. Attach the rear cover and secure to the unit using existing hardware.
10. Connect the power cord and power up the unit.
11. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.

Section 21. Exhaust Valve Replacement (PD03 only)

21.1 Installation Procedure

21.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 21-1) and detach the rear plastic cover from the unit.

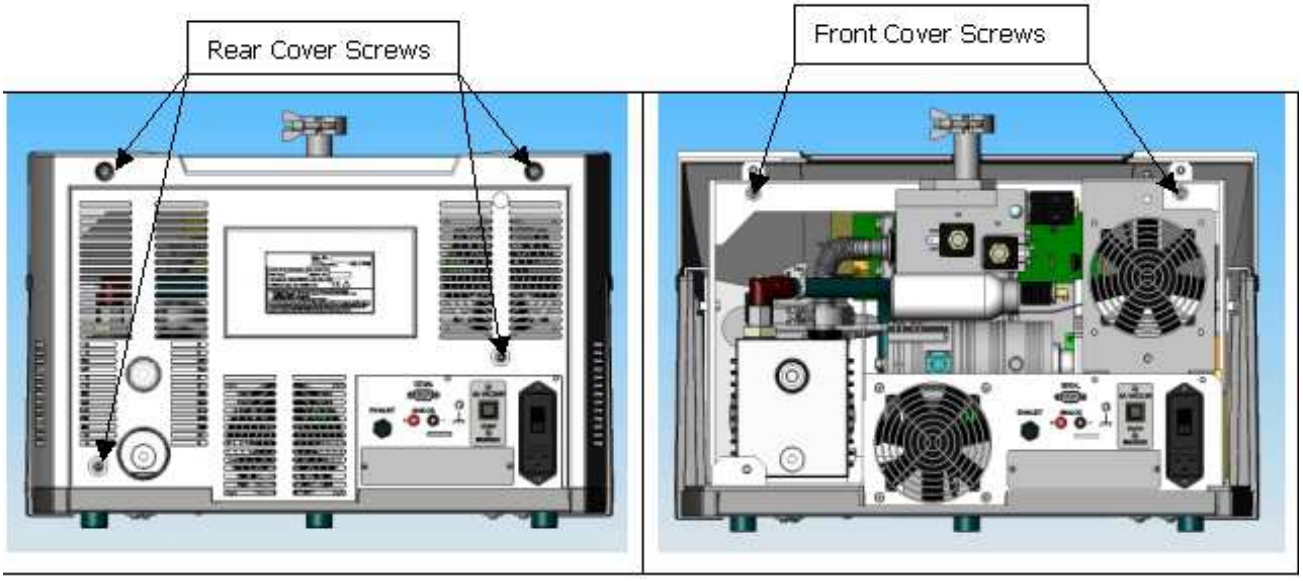

Figure 21-1 Rear and Front Cover Screws

4. Unscrew the black cover using the Philips head screw, pull up the cover and disconnect (red arrow in Figure 21-2)

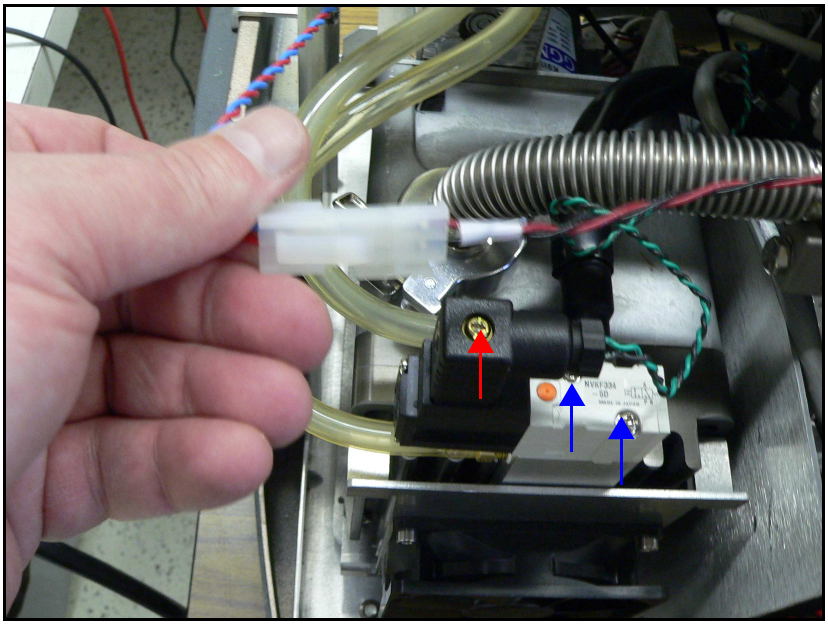

Figure 21-2 Unit Screws

5. Unscrew the two Philips head screws (blue arrow in Figure 21-2) and pull the complete black/grey body up and out.
6. Mount new unit and replace the three Philips screws.
7. Attach the front cover and secure to the frame using existing hardware.
8. Attach the rear cover and secure to the unit using existing hardware.
9. Connect the power cord and power up the unit.
10. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
11. Agilent recommends a full calibration of the unit prior to leak test operations.

Section 22. Diaphragm Pump Replacement (PD03 only)

22.1 Installation Procedure

22.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver
- ❑ Adjustable Wrench

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 22-1) and detach the rear plastic cover from the unit.

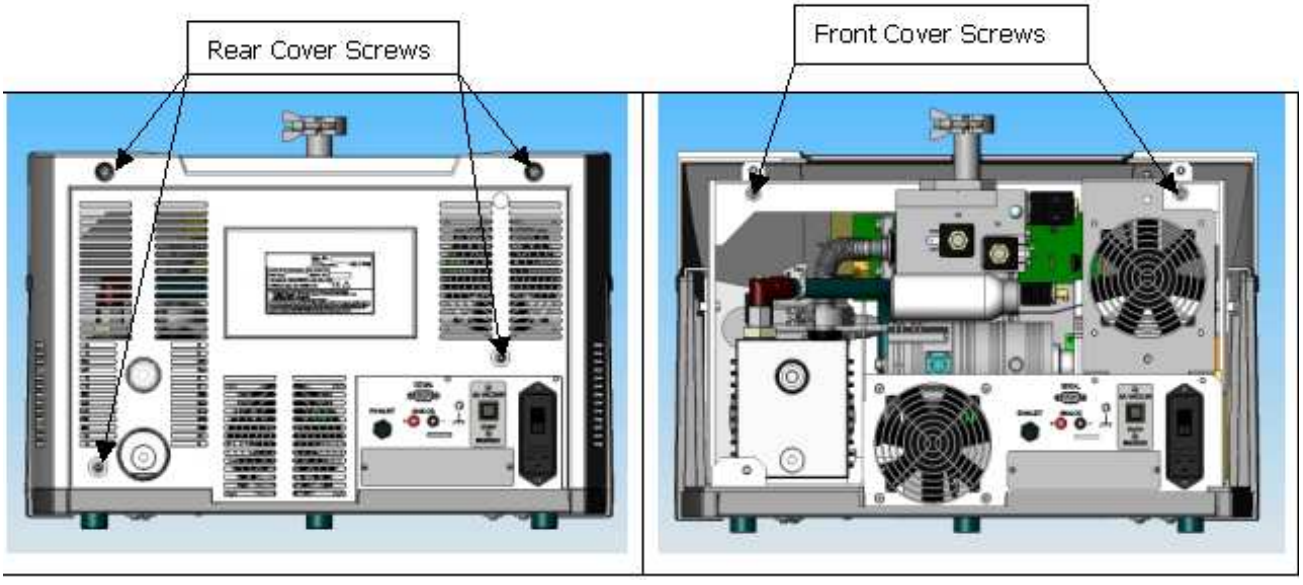

Figure 22-1 Rear and Front Cover Screws

4. Disconnect the R3359-301 Molex connector to the Clippard valve (Figure 22-2).

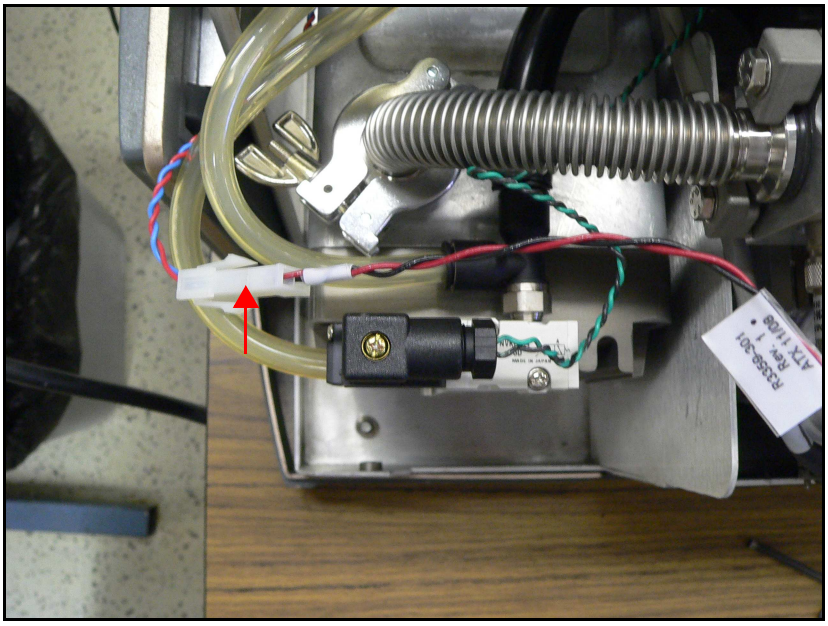

Figure 22-2 Molex Connector

5. Remove the ground connection to the system body (red arrow in Figure 22-3).

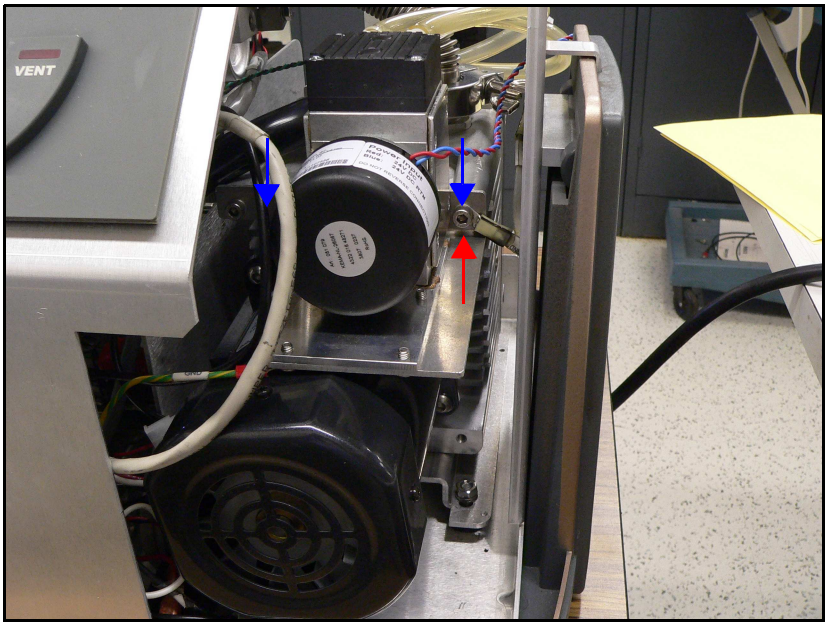

Figure 22-3 Ground Connection

6. Disconnect the two M4 screws mounting the plate to the scroll pump assembly (blue arrow in Figure 22-3).

7. Remove the diaphragm pump assembly, turn it over and unscrew the four M2 screw holding the pump to the plate (Figure 22-4 - two shown).

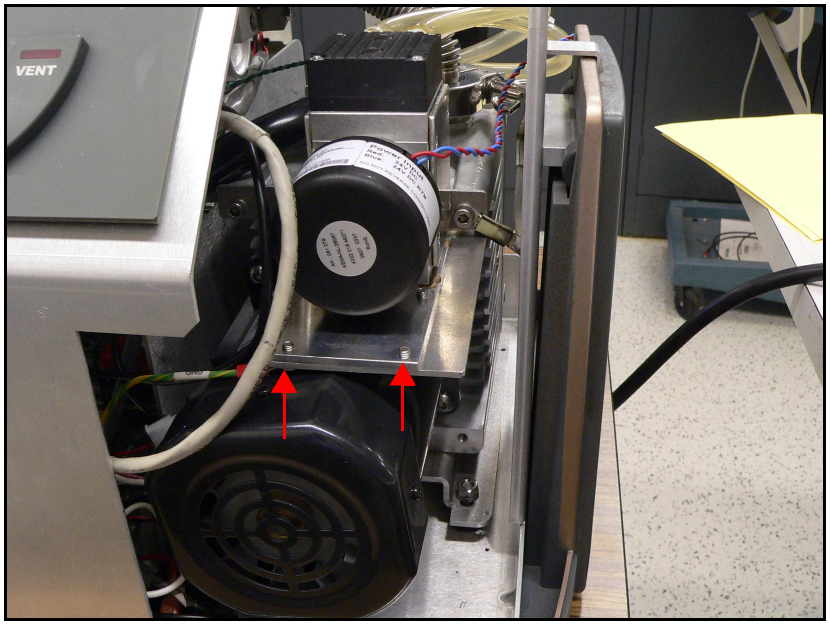

Figure 22-4 Pump to Plate Connections

8. Reattach the new pump to the plate.
9. Reattach the plate to the scroll pump.
10. Reattach the ground and Molex connections.
11. Attach the front cover and secure to the frame using existing hardware.
12. Attach the rear cover and secure to the unit using existing hardware.
13. Connect the power cord and power up the unit.
14. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.
15. Agilent recommends a full calibration of the unit prior to leak test operations.

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Section 23. Diaphragm and Seal Replacement (PD03 only)

23.1 Installation Procedure

23.1.1 Equipment Required

- ❑ Extended Length M5 Allen Wrench
- ❑ Metric Allen Wrench Set
- ❑ M3 Phillips Head Screw Driver
- ❑ Phillips Head Screw Driver, #1
- ❑ Felt Tip Pen

For clarity, some items have been omitted from views.

WARNING *Disconnect power from the unit before performing any maintenance procedure that requires physically disconnecting any part of the system.*

1. Turn off the power switch located on the back of the unit and unplug.
2. Wait 30 seconds for the high voltage to dissipate.
3. Using an extended length M5 Allen wrench, remove the four screws holding the rear plastic cover (Figure 23-1) and detach the rear plastic cover from the unit.

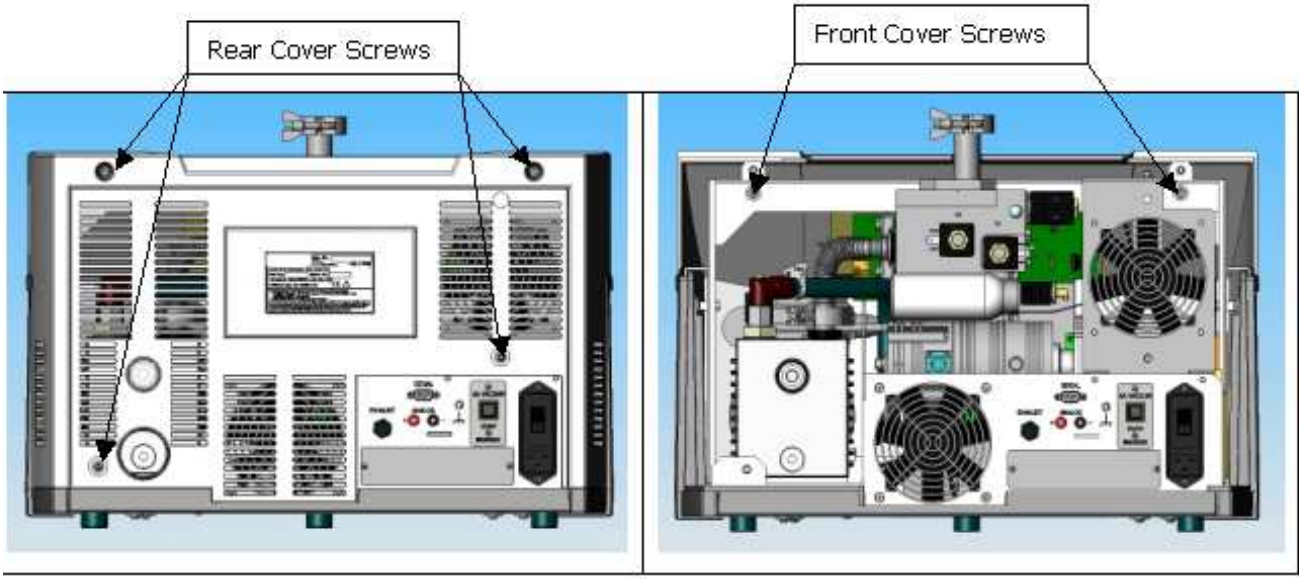

Figure 23-1 Rear and Front Cover Screws

NOTE

Always change the valve plates, diaphragm and sealing rings at the same time.

4. Remove the pump head by (Figure 23-2):

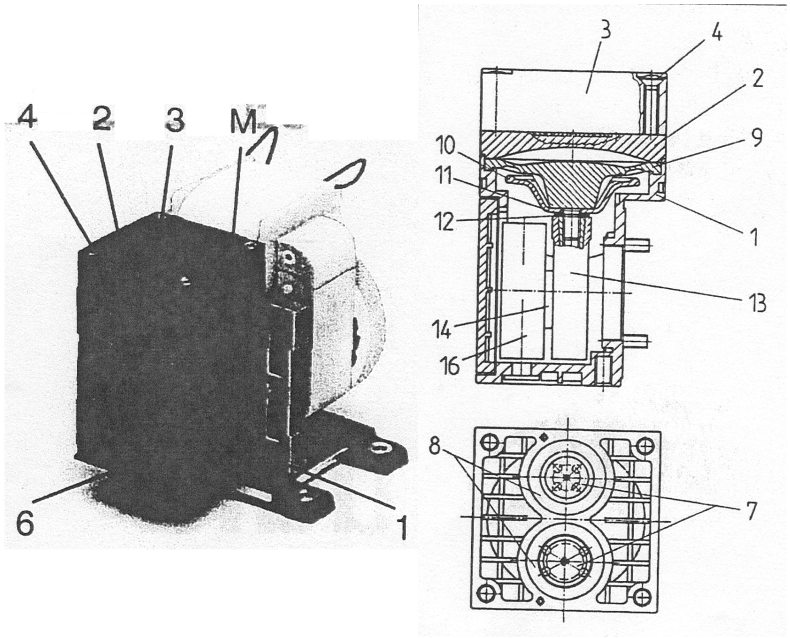

Figure 23-2 Pump Head Removal

a. Making a mark (M) on the head plate (3), intermediate plate (2), and housing (1) with a felt-tip pen.

b. Undoing the 4 screws (4) in the head plate and lifting the head plate, with the intermediate plate, off the pump housing.

c. For models with:

❑ *DC motors (no cooling fan):* Removing the cover (6) from the pump housing (1) by inserting a screwdriver into the slots on the sides, and prying the cover off (with care the adhesive gasket between cover and housing may be reused).

❑ *No fan:* Reference is made to turning or holding the cooling fan, the necessary operations must be carried out by turning or holding the counterweight (16).

5. Change the diaphragm by (see Figure 23-2):

a. Turning the fan to bring the structured diaphragm (9) to top dead center.

b. Lifting the edge of the diaphragm and, gripping it on opposite sides, unscrewing it by turning counterclockwise.

CAUTION

Ensure that the disc s spring (12) and diaphragm spacers (11) on the threaded portion of the diaphragm do not fall into the housing.

c. Taking the disc spring (12), diaphragm spacer(s) (11), and diaphragm support (10) off the threaded portion of the diaphragm and retaining them.

d. Ensuring that all parts are free from dirt and clean them, if necessary.

e. Placing the diaphragm support, diaphragm spacer(s), and disc spring, in that order, on the thread part of the new diaphragm. The concave side of the disc spring must be towards the diaphragm.

f. Turning the fan until the connecting rod (13) is at top dead center.

g. Screwing the diaphragm, complete with diaphragm support, diaphragm spacer(s), and disc spring, into the connecting rod (clockwise) and tightening it by hand.

6. Change the valve plates by (see Figure 23-2 on page 23-2):

   a. Separating the head plate (3) from the intermediate plate (2).

   b. Removing the valve plates (7) and sealing rings (8) from the intermediate plate.

   c. Checking that the valve seats in the head plate and the intermediate plate are clean. If scratches, distortion, or corrosion are evident, replace that part.

   d. Laying the new valve plates in the intermediate plate recesses. The valve plates for suction and pressure sides are identical, as are upper and lower sides of the plates.

   e. Ensuring the valve plates are not deformed by moving them gently sideways in their recesses.

   f. Laying the sealing rings on the intermediate plate.

7. Refit the pump heads by (see Figure 23-2 on page 23-2):

   a. Turning the fan to bring the diaphragm to top dead center.

   b. Placing the intermediate plate (2), with valve plates (7), sealing rings (8), and head plate (3) on the housing, in the position indicated by the (M).

   c. Checking that the head plate is centered by moving it gently sideways.

   d. Gently tightening the screws (4), evenly and diagonally.

   e. Turning the fan to check that the pump rotates freely.

   f. Turning the fan again to bring the diaphragm to top dead center.

   g. Tightening the screws (4).

   h. *For DC versions (no cooling fan):* Reattaching the cover (6) to housing (1).

8. Attach the front cover and secure to the frame using existing hardware.

9. Attach the rear cover and secure to the unit using existing hardware.

10. Connect the power cord and power up the unit.
11. Watch the home screen to verify the *Spectube Pressure Wait* message progresses to *Stabilization Wait* and *System Ready* within ten minutes.

    Refer to the operator's manual if the system fails to reach the *System Ready* mode.

Section 24. Manual Tuning, Calibration, Maintenance Screen and Fore Pump Set-Up

24.1 Manual Tuning

1. Press **Set-Up** on the **Menu** screen to open the Set-Up screen.

CAUTION

The items configured using the Set-Up sub-screens significantly affect the performance of the leak detector and must only be accessed by trained service personnel.

Many of the values for the parameters included on the Set-Up sub-screens are calculated when the leak detector performs functions such as Calibrate and tuning. Changing these values can cause unreliable test results.

2. Press **Manual Tuning** on the Set-Up screen and the Manual Spectrometer Tuning screen appears (Figure 24-1).

   Use this screen to manually adjust the parameters of the ion source in the spectrometer for a maximum helium signal.

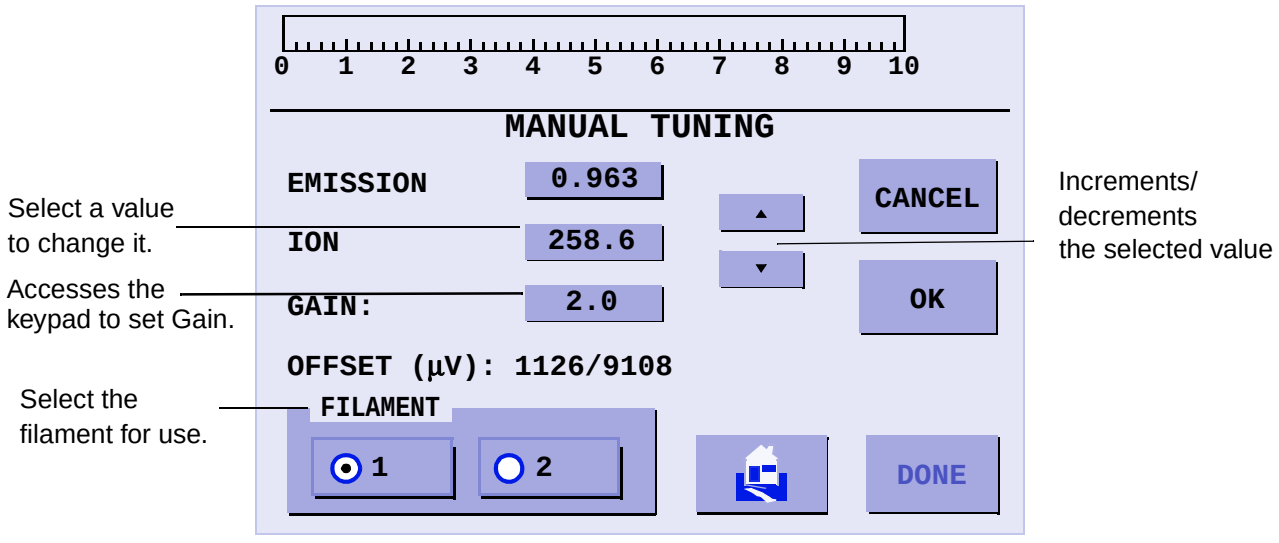

Figure 24-1 Manual Tuning

Emission Current

Displays the value of the existing Emission current of the spectrometer Ion Source and allows for emission current adjustment. The emission current parameter tunes the leak detector, maximizing the leak detector output for a peak helium signal.

Typical Emission current values range from .5 mA to 1.0 mA.

Ion Voltage

Displays the current ion voltage value of the spectrometer Ion Source. The ion voltage parameter tunes the leak detector, maximizing the leak detector output for a peak helium signal.

Typical ion voltage values range from 250 VDC to 270 VDC. The ion voltage value is automatically adjusted and set during the full calibration routine.

Filament

Switches between Filament 1 and 2. The filament selection can be performed manually, but occurs automatically if the current operating filament burns out. A calibration routine is recommended every time the operating filament is changed.

The change appears on the Home and System Information screens and *C* flashes on the Home screen to indicate that calibration is required.

NOTE

Replace the filament inside the spectrometer as soon as it is convenient after the spare filament has been put into use.

Gain

Displays the current value of the Gain of the system. Gain is used to scale the indicated value of a known leak to agree with a known correct value. The gain parameter is adjusted after the leak detector has been tuned to helium. It is automatically set by the Calibrate Procedure. Use the value button (next to Gain) to change the Gain value.

NOTE

Changing Gain changes Zero by the same percentage, which can affect system transfer points.

Typical gain values range from 0.8 to 3.0. The higher the gain, the more noise shows up in the least sensitive range.

To change a manual tuning parameter:

1. Press the desired parameter.

   When you press the box containing the desired variable, a highlighted indicator appears to the right of the numbers.

NOTE

*Once a change of value is initiated, you can press **Cancel** to exit the screen and revert to the original value*

2. Press the Up or Down arrow to peak the helium signal.

NOTE

*Do not press the **ESC** box before pressing the **OK** box. This causes the selected parameter to revert to its previously stored value.*

3. Press **OK** to accept the changes and to store the new parameter value in the leak detector memory.
4. Press **Done** to exit the screen and return to the previous menu screen.

To manually tune the leak detector:

1. Place the system in TEST mode.
2. Navigate to the Control Panel and turn the STD LEAK ON.
3. Navigate to the Calibration Set-Up screen and write down the INTERNAL CALIBRATED LEAK value. This value is temperature compensated.
4. Navigate to the Manual Tuning screen and:
   - ❑ Set the GAIN to 1.0.
   - ❑ Set the EMISSION to between 0.5000 and 0.6000.
   - ❑ Adjust the ION value up or down to attain the maximum value. Ideally, the ION value should be between 250 and 270.
   - ❑ Adjust the EMISSION to attain the maximum value. Ideally, the EMISSION value should be between 0.500 and 1.000.
   - ❑ Set the GAIN so that the leak rate on the screen matches the value of the internal leak you wrote down.
5. Navigate to the CONTROL PANEL and turn the STD LEAK OFF.

24.2 Gauge Calibration

1. Press **Set-Up** on the **Menu** screen to open the Set-Up screen.

CAUTION

The items configured using the Set-Up sub-screens significantly affect the performance of the leak detector and must only be accessed by trained service personnel.

Many of the values for the parameters included on the Set-Up sub-screens are calculated when the leak detector performs functions such as Calibrate and tuning. Changing these values can cause unreliable test results.

2. Press **Gauge Calibration** on the Set-Up screen and the Gauge Calibration screen appears (Figure 24-2).

Use this screen to perform a calibration on the test port thermocouple gauge.

Calibrate the thermocouple gauge for the most accurate operation. To calibrate the gauge:

1. Set a calibration point at atmosphere.
2. Set a calibration point at a low vacuum level (<= 1E-4 Torr).

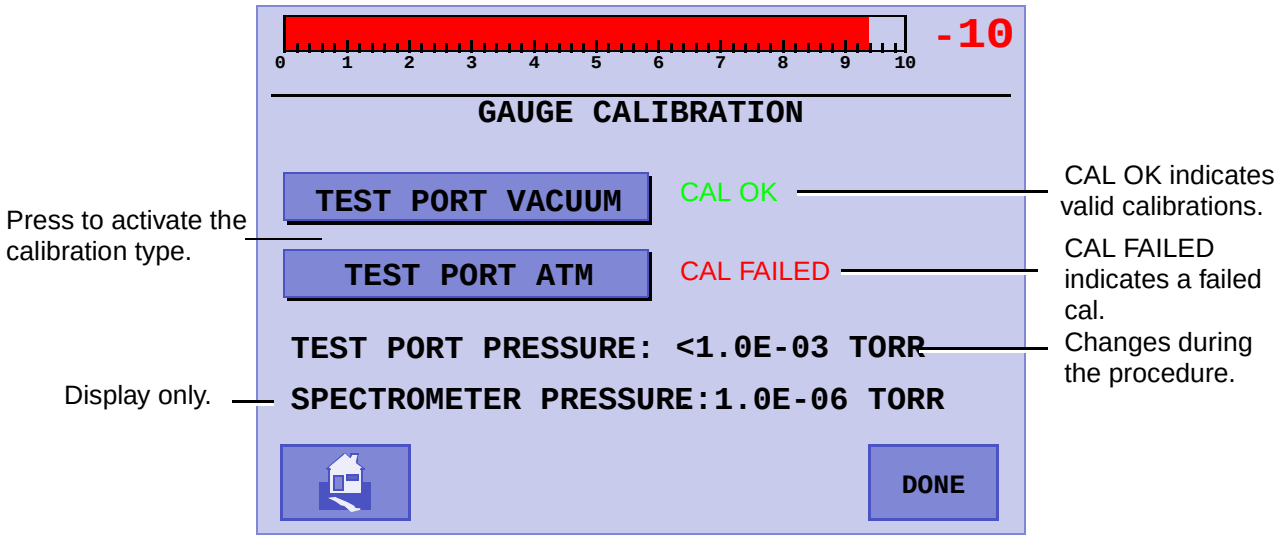

Figure 24-2 Gauge Calibration

Test Port Vacuum	Calibrates the thermocouple gauge zero value. Do this at or below 1E-4 Torr.
Test Port ATM	Sets the thermocouple atmospheric value. Perform this operation only when the test port is at atmosphere.
Test Port Pressure and Spectrometer Pressure	The Test Port Pressure and the Spectrometer Pressure values appear on this screen for reference.

Test Port Pressure Gauge Calibration Procedure	Calibrates the test port pressure thermocouple gauge. **Perform both the Vacuum and Atmospheric Calibration procedures in the order written, TEST PORT VACUUM and the TEST PORT ATM.**

NOTE

Display of <1.0E-03 indicates the pressure is less than the lowest displayable pressure of the TC gauge which is 1.0E-03.

24.2.1 Vacuum (Low Pressure) Calibration

To perform Vacuum Calibration:

1. Verify that the leak detector is in the System Ready condition and that a test port cap is in place.
2. If the system is not already in Vent mode, press **VENT**.
3. Press **Test** and verify that the leak detector transfers to *Fine Test* mode, displaying 10^{-9} atm cc/sec or lower.
4. Wait approximately 5 minutes for the vacuum system pressure to stabilize.
5. Press **Test Port Vacuum**.

   You will receive one of the following messages:

   - A *Cal OK* indicator, to the right of the Test Port TC Zero box confirms that the calibration was successful.
   - A *Failed* message indicates that the calibration was not successful.

     A *Failed* message results from a defective or contaminated thermocouple gauge, or the fact that the actual pressure was not at or near zero. Verify the latter case using an appropriate vacuum gauge installed on the test port.
6. Press **Done** to leave the screen and return to the previous menu.

24.2.2 Atmospheric Calibration

To perform Atmospheric Calibration:

1. If the system is not already in Vent mode, press **VENT**.
2. Wait approximately ten seconds for the test port pressure to stabilize, then move to the Gauge Calibration screen (Figure 24-2 on page 24-4).
3. Press **Test Port Atm**.

   You will receive one of the following messages:

   - A *Cal OK* indication, to the right of the Test Port TC Atm box, confirms that the calibration was successful.

- A *Failed* message indicates that the calibration was not successful. This is the result of a defective or contaminated thermocouple gauge, or that the actual pressure was not at or near atmosphere. Verify the latter case using an appropriate vacuum gauge installed on the test port.

4. Press **Done** to leave the screen and return to the previous menu.

24.3 Maintenance Screen

Use this screen to access the Internal Calibration Leak screen.

1. Press **Set-Up** on the **Menu** screen to open the Set-Up screen.

CAUTION

The items configured using the Set-Up sub-screens significantly affect the performance of the leak detector and must only be accessed by trained service personnel.

Many of the values for the parameters included on the Set-Up sub-screens are calculated when the leak detector performs functions such as Calibrate and tuning. Changing these values can cause unreliable test results.

2. Press **Maintenance** on the Set-Up screen and the Maintenance screen appears (Figure 24-3).

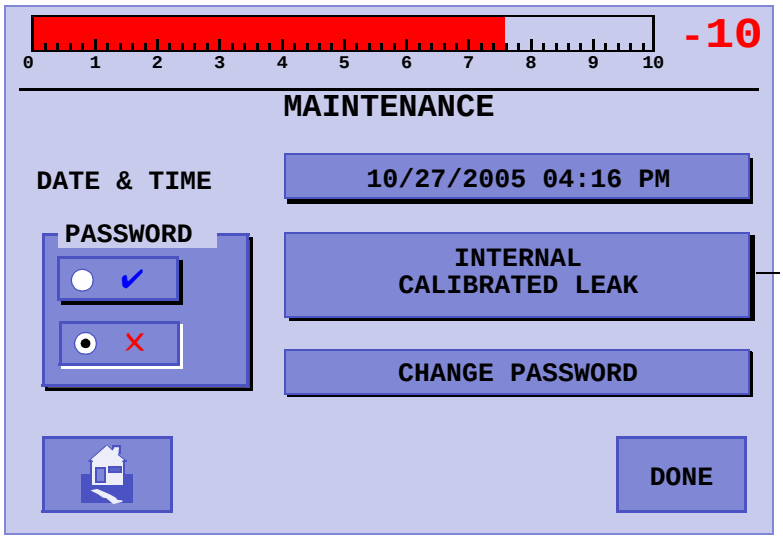

Figure 24-3 Maintenance

3. Press **Internal Calibrated Leak**.

   The Internal Calibrated Leak screen appears (Figure 24-4).

From this screen you can also access the Cal Leak Expiration Set-Up (Section 24.3.1 “Cal Leak Expiration Set-Up” on page 24-8).

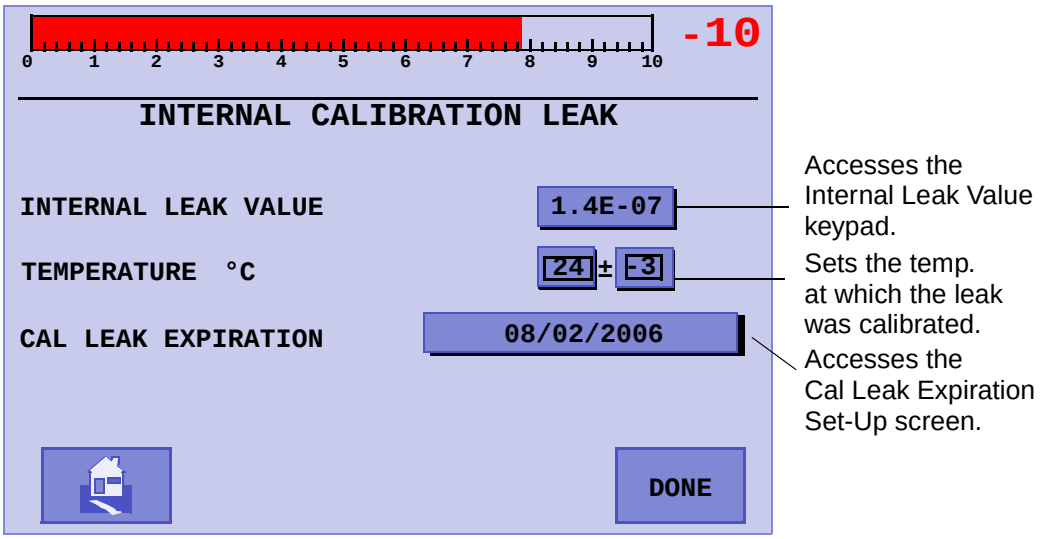

Figure 24-4 Internal Calibrated Leak

To use this screen:

1. Press a button to activate its field.

   A keypad appears.

2. Enter the required values as shown on the calibrated leak label.
3. Repeat step 1 and 2 for each desired item.
4. Press **Done** to exit the screen.

The value of the internal calibrated leak as shown on the CALIBRATION SET-UP screen is compensated for temperature using the temperature sensor located on the calibrated leak. The calibrated leak is not compensated for temperature if any of the following conditions exist:

- ❑ The temperature sensor on the calibrated leak fails or there is a cable connection problem.
- ❑ The temperature sensor reading is out of the operating range. The operating temperature range is from 10.0 to 45.0° C (50 to 113° F).
- ❑ The internal calibrated leak is not a E-7 or E-8 range leak.

24.3.1 Cal Leak Expiration Set-Up

❑ Press the button next to the *Cal Leak Expiration* text on the Internal Calibrated Leak screen.

The Cal Leak Expiration Set-Up screen appears (Figure 24-5).

The Cal Leak Expiration is usually one year from leak installation. When the calibrated leak expires, a message appears on the Home screen.

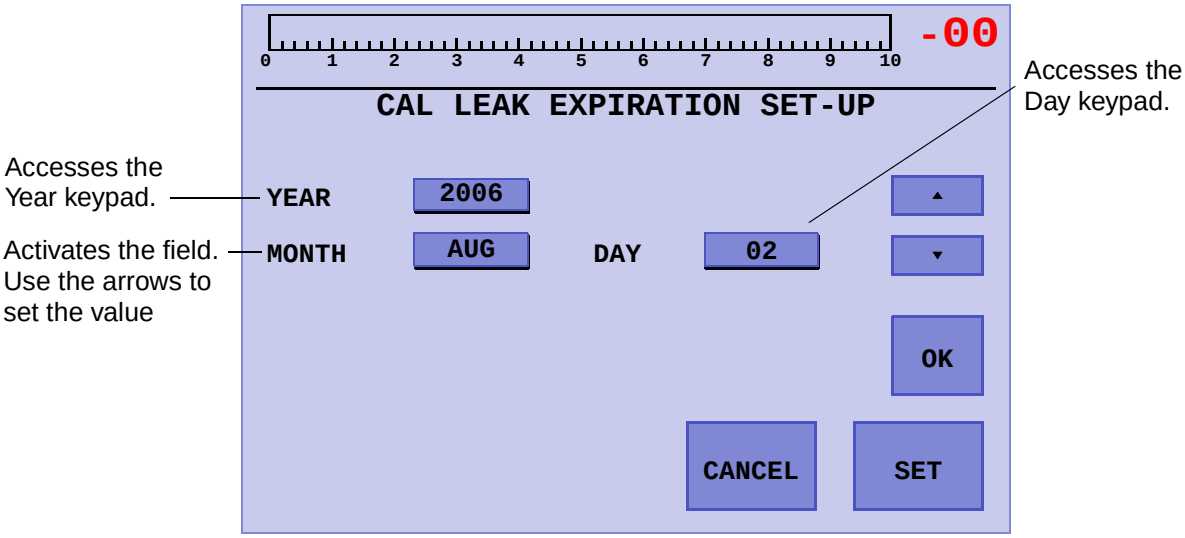

Figure 24-5 Cal Leak Expiration Set-Up

To use this screen:

1. Press the button next to *Year* or *Month* and a keypad appears to set the value.
2. Press **Set** for each item configured.
3. Press the button next to *Day,* use the up and down arrows to set the value and press **Set**.
4. Press **OK** to exit the screen.

24.4 Fore Pump Set-Up

1. Press **Set-Up** on the **Menu** screen to open the Set-Up screen.

CAUTION

The items configured using the Set-Up sub-screens significantly affect the performance of the leak detector and must only be accessed by trained service personnel.

Many of the values for the parameters included on the Set-Up sub-screens are calculated when the leak detector performs functions such as Calibrate and tuning. Changing these values can cause unreliable test results.

2. Press **Fore Pump** on the Maintenance screen.

   The Fore Pump Set-Up screen appears (Figure 24-6). Use this screen to select fore pump speed and type.

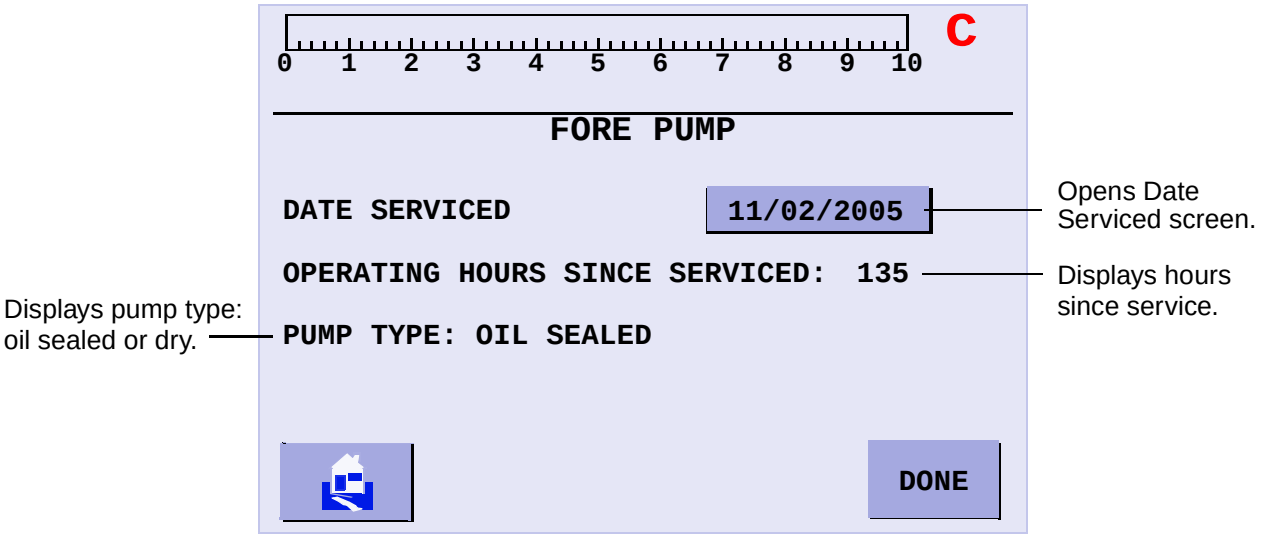

Figure 24-6 Fore Pump Set-Up

24.4.1 Date Serviced

❑ Press the date on the Fore Pump screen and the Date Serviced screen appears (Figure 24-7).

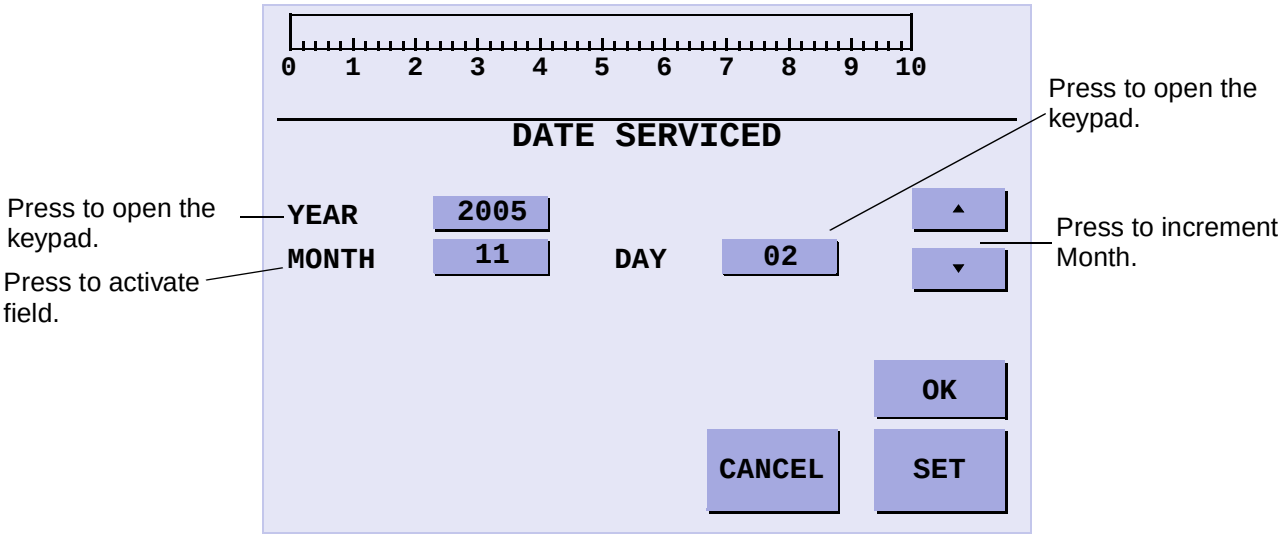

Figure 24-7 Date Serviced

To use this screen:

1. Press the button next to *Year* or *Day* and a keypad appears to set the value.
2. Press **Set** for each item configured.
3. Press the button next to *Month,* use the up and down arrows to set the value and press **Set**.
4. Press **OK** to exit the screen.

Section 25.Maintenance

NOTE

All service must be performed by trained personnel only.

A mass spectrometer leak detector requires periodic maintenance to ensure continued reliable operation. After prolonged use, the leak detector accumulates contaminants from even the cleanest of products tested that eventually impair operation. A thorough disassembly and cleaning of the entire vacuum system, which includes the valve block and spectrometer, restores normal operation. For heavy production use, more frequent overhauls may be needed. In most cases, maintenance personnel do this work, but Agilent can also do this work under the terms of a service contract.

This maintenance section covers daily and as-required maintenance. It does not cover overhaul of the entire vacuum system. Refer to the *VS Series Helium Mass Spectrometer Leak Detectors Field Service Component Replacement Manual* for annual and preventive maintenance procedures.

If your leak detector requires service that is not covered in this section, contact Agilent Customer Service. See the back cover of this manual for a listing of our sales and service offices.

Important Reminders

In addition to the safety notes at the beginning of this manual, heed the following notes, cautions, and warnings when performing maintenance.

WARNING

Disconnect power from the leak detector before performing any maintenance procedure that requires physically disconnecting any part of the system.

The VS Series leak detector has a battery backed clock which uses a primary (non-rechargeable) lithium coin battery from Panasonic, P/N BR2477A/HB (3.0V, 1Ah) that is permanently soldered onto a Motherboard PCB. Never replace this battery with a rechargeable type. Use only the primary type of lithium battery. Only a qualified technician should replace any battery. The battery has a life of 7 to 10 years.

The VS Series leak detector uses fuses and circuit breakers that are not operator replaceable. Only a qualified technician should replace any fuse.

Information about the fuses and circuit breakers is given in Table 25-3 on page 25-4.

Cleanliness is vital when servicing the leak detector or any vacuum equipment. There are some techniques more important in leak detector servicing than in general vacuum work:

CAUTION

Do not use silicone oil or silicone grease.

Use powder-free butyl or polycarbonate gloves to prevent skin oils from getting on vacuum surfaces.

Do not clean any aluminum parts with Alconox®. Alconox is not compatible with aluminum and will cause damage.

NOTE

Agilent does not recommend the use of vacuum grease. Vacuum grease absorbs helium tracer gas and releases this slowly resulting in helium background during leak test operations. If it must be used, use it sparingly and avoid silicone types. Apiezon® L grease is recommended (Agilent Part No. 695400004).

When removing, checking or replacing O-rings:

CAUTION

Remove O-rings carefully with your fingers. Do not use metal tools for this task. This prevents scratching of any sealing surfaces.

Wipe all O-rings clean with a lint-free cloth before installation to ensure that no foreign matter is present to impair the seal.

Do not use grease or any other substances on O-rings or metal seals that will come in contact with the spectrometer.

Do not use alcohol, methanol or other solvents on O-rings as this causes deterioration and reduces their ability to hold a vacuum.

NOTE

If applicable, apply a small amount of Apiezon® L grease and wipe the O-rings shiny dry.

NOTE

Due to the effective cleaning nature of VacuSolv solvent and its residue-free properties, Agilent' Component and Spectrometer Cleaning Kit (Part Number 670029096), used in accordance with the kit instructions, is recommended for cleaning spectrometer components. The kit can also be used for fine cleaning of other parts in the leak detector's vacuum system such as valves and fittings. No rinsing steps or high-temperature drying are required following cleaning with VacuSolv. Although appropriate precautions are advised, VacuSolv is compatible with most materials and does not contain toxic chemicals or CFCs (chlorofluorocarbons). Other acceptable solvents are isopropyl alcohol (IPA) or Dow Corning® OS-20.

For simplicity, the maintenance functions in this section are grouped by recommended frequency, as shown in Table 25-1, based on assumed daily use.

Table 25-1 Scheduled Maintenance

Description	Daily	12 Months
Calibration check	X	
Recalibrate the internal calibrated leak		X
Spectrometer overhaul		X

Maintenance functions that may be required on a demand basis, such as changing a filament after filament failure, are listed in Table 25-2.

Table 25-2 As-Required Maintenance

Function	Most Common Symptom
Spectrometer cleaning	Loss of sensitivity, increase in background, high ion voltage (> 300 VDC), high gain required to tune the leak detector.
Filament replacement	Filament failure (as soon as convenient after second filament is in use).
Tuning adjustments	If calibration is not successful or if the system is calibrated to an external leak, tuning can maximize the helium signal.
Mechanical pump fluid change	Persistent, high helium background signal. Fluid contamination (dirty brown color indicates burnt or contaminated fluid, milky white consistency indicates high water vapor content in fluid).

Table 25-3 lists the fuses and circuit breakers.

Table 25-3 Fuses and Circuit Breakers

Function	Type, MFG, PIN	Location
Circuit Breaker	❑ Main Power Supply: 20 A, 250 V AC, SCHURTER Model EF12, PIN EF12.2196.1110.01 ❑ Internal Vacuum Pump: 6 A, 250 V E-T-A, PIN 1110-Fl12-PIMl-6 A	Power Entry Module Rear Panel
Fuses (PCB overcurrent protection)	1.85 A, 33 VDC, Raychem SMD185-2	❑ Motherboard (RT400) ❑ Valve Driver (Fl) ❑ Ion Source (Fl) ❑ Front Panel Controller (RT400)
	5x20mm, T4A, 4A, 250V AC, Cooper/Bussmann S505-4A	Turbo Controller (F2)

NOTE

Only a qualified technician should replace circuit breakers and fuses. Use only circuit breakers and fuses of the same type and rating.

25.1 Daily Maintenance

25.1.1 Sensitivity Check

To perform a sensitivity check:

1. Turn on the Std Leak in the Control Panel screen.
2. Compare the value on the Home screen to the value of the known calibrated leak on the Internal Calibrated Leak screen.
3. If the values do not match, press **Calibrate** on the Control Panel screen to perform an automated calibration and then repeat step 1.

   If specification is still not met, Manual Tuning may be required.

25.2 Dry Nitrogen Vent

You may want to vent the leak detector test port with dry nitrogen when the system is vented. Venting with dry nitrogen can be helpful in very humid environments to keep the test port as dry as possible which reduces the time required to pump down the system.

To do this:

1. Turn the system power OFF.
2. Remove the power cord from the power input and remove the rear plastic from the system.
3. Locate the filter that provides venting for the test port. It is on the valve block (on valve V7) on the back facing surface, in the upper right hand corner.
4. Remove the filter and install a nitrogen connection into the port. The threads of the port are a size Rc 1/8 (metric).
5. Feed the nitrogen line through the lower left hand opening of the rear panel, where the foreline manifold or mechanical pump drain access is located.
6. Replace the rear cover and re-connect the power to the system.

NOTE

The nitrogen supply line should have a pressure relief valve installed so that the pressure does not exceed two psi.

25.3 Spare Parts List

Table 25-4 Leak Detector Spare Parts

Assembly	Part Number
Motherboard PCB	R2101301
CPU PCB	R2361303
Ion Source PCB	R2120301
Valve Driver PCB	R2104301
24 VDC Turbo Controller PCB	9699518
Front Panel Controller PCB	R2117301
Front Panel Sub-Assembly	R2021301
AC-DC Power Supply	659077040
Spectrometer Assembly	R2041301
TC Upgrade Kit	VS531AIC
Filament Replacement	VSFLDFR
Valve Block O-ring Kit	VSFLDOV
Metal Gasket Kit	VSFLDMG
Discrete I/O PCB	R2111501
Test Port TC	F0472301
Wireless Base PCB	R2541301

25.4 Leak Detector Accessory Item List

Table 25-5 Leak Detector Accessory Item List

Assembly	Part Number
Flapper Box, NW25 Flange	L6241302
Power Probe, 10’ (NW25 Flange)	K9565306
Power Probe, 25’ (NW25 Flange)	K9565307
Spare Tip Filters for Power Probe (Qty: 10)	K9565303
Throttle Valve (NW25 Flange)	R1947301
Elite-Z Mechanical Pump Fluid	695409005
Calibrated Leak, 10^{-5}, 10^{-6} (NW25 Flange)	F8473320
Calibrated Leak, 10^{-7} (NW25 Flange)	F8473321
Calibrated Leak, 10^{-8} (NW25 Flange)	F8473322
Calibrated Leak, 10^{-9} (NW25 Flange)	F8473323
Calibrated Leak, 10^{-10} (NW25 Flange)	F8473324
Oil Mist Eliminator	VSFLDME
Filter, Oil Mist Eliminator	649071021
Inlet Adapter Kit (NW25-1-1/8” Compression)	LDCOMPINADKIT
Wireless Remote Unit, Model VSLDWRC	VSLDWRC
Field Installed, I/O Assembly	VSFLDIO
Field Installed, Wireless Remote Base Unit	VSFLDWB

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Section 26. Leak Checking for Reliability

Accuracy, reliability, and stability of any mass spectrometer leak detector depends upon the leak-free integrity of its own vacuum system. Inherent helium background and its effect on sensitivity demands elimination of all detectable leaks. If performance degrades during operation or after some part of the vacuum system is opened for service, a methodical leak check eliminates the possibility of a leak as the cause.

NOTE

To ensure reliable testing, the leak detector must be leak checked before performing testing after servicing any part of the vacuum system.

26.1 General Suggestions for Leak Checking

The following suggestions apply whether leak checking components, systems, or the leak detector itself:

- ❑ When spraying suspected leak locations:
  - ❑ Always apply helium sparingly.
  - ❑ Since helium rises, start at the highest points first.
  - ❑ Apply helium downstream from the source of a draft first, or deflect the draft until leak checks are completed.
- ❑ If vent grooves exist at flanges or other assembled seals, apply helium to these points (rather than spraying a general area) to:
  - ❑ Obtain the most positive response.
  - ❑ Minimize the use of helium.
  - ❑ Save time in checking.
- ❑ Locate and repair large leaks before attempting to locate extremely small leaks.
- ❑ Limit the search to a general area of the test piece by isolation methods to shorten the time required to locate both large and small leaks. Isolation methods include:
  - ❑ Bagging
  - ❑ Masking
  - ❑ Shielding with tape, plastic film or duct seal (if applied properly)
- ❑ Use only enough helium to reach the leaks. Do not flood the area.

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Appendix A. Communications Protocol

This appendix defines the technical specifications for the RS-232 protocol used with the leak detector and describes the customer-configured inputs/outputs.

A.1 Protocol (RS-232)

RS-232 ports operate at 9600 baud, 8 bits, no parity, and one stop bit.

All characters transmitted to the leak detector are echoed by the leak detector. Commands, inquiries, and strings of both commands and inquiries must be terminated by a carriage return <CR>; the carriage return is echoed as a space character.

The maximum length of the input is 80 characters; if no carriage return has been received before the 80th character, execution of the command string begins anyway.

Words that begin with:

- **?** are inquiries for the controlling device to determine the current state or value of a leak detector parameter.
- **PUT-** are commands for the controlling device to set the current state or value of a volatile leak detector parameter.
- **INIT-** are commands for the controlling device to set non-volatile leak detector parameters.

Other commands do not require a parameter and do not begin with any special characters.

Successful inquiries respond with data, followed by a space, then: **ok**<CR><LF>, as specified in the tables of this appendix. Unsuccessful inquiries respond with the offending inquiry followed by a space, then: **#?**<CR><LF> (line feed, <LF>).

Inquiries, parameters, and commands can be concatenated. Each word or numeric parameter is followed by one or more spaces. The string is terminated by a <CR>, which causes execution to begin.

Successful strings respond with the specified data for the input inquiries in the order the inquiries were issued, followed by: **ok**<CR><LF>.

Unsuccessful strings respond with the *first* offending command followed by a space, then: **#?**<CR><LF>. All commands and inquiries following the failed word are ignored; all parameters are discarded.

Table A-1 on page A-5, Table A-2 on page A-7, Table A-3 on page A-10, and Table A-4 on page A-11 outline the available control and query commands.

A.2 Communicating with RS-232

The RS-232 Protocol is intended for diagnostic purposes and initial set-up inquires. The RS-232 connection is located on the rear D-sub 9-pin connector.

The leak detector RS-232 port is not an interrupt-driven port. It is configured as DTE (Data Terminal Equipment), therefore the leak detector's RS-232 Protocol cannot be sent as strings.

NOTE

When programming with virtual instrumentation programs such as LabView, TestPoint, or Visual Basic, try one the following two methods:

- ❑ Transmit the intended command one character at a time with a minimal delay time of 50 milliseconds between each character. Terminate the command with a carriage return (CR).
- ❑ Transmit the intended command one character at a time. Wait for an echoed response from the leak detector before transmitting the next character. Terminate the command with a carriage return (CR)

Windows 95 and later versions contain a serial communications program called HyperTerminal, a useful tool in establishing communication between the leak detector and a PC.

A.2.1 Windows HyperTerminal Set-Up Instructions

To set up Windows HyperTerminal:

1. Click **Start**.
2. Select *Programs > Accessories > Communications > HyperTerminal*.
3. Double-click **Hypertrm.exe**.

   The Connection Description dialog box appears.
4. Enter a name and choose an icon for the connection, for example: leak detector RS-232.
5. Click **OK**.

   The Connect To dialog box appears.
6. Select a COM port from the *Connect Using*: the pull-down list.

   The Com Properties/Port Setting dialog box appears.

7. Configure the following settings:
   - ❑ Bits per second (baud rate) – **9600**
   - ❑ Data bits: – **8**
   - ❑ Parity: – **None**
   - ❑ Stop bits: – **1**
   - ❑ Flow Control: – **None**
8. Click **OK**.
9. Select **Properties** from the File menu.

   The Properties window appears.
10. Configure the following settings on the Connect To tab:
    - ❑ Connect using – Verify the COM port is correct.
    - ❑ Click **Configure** and verify the port settings are correct.
11. Ensure that the Settings tab is configured as follows:
    - ❑ Terminal keys radio button selected.
    - ❑ Ctrl+H radio button selected.
    - ❑ Auto detect selected from the Emulation pull-down list.
    - ❑ ANSI entered in the Telnet terminal ID.
    - ❑ 500 set in the Background buffer lines field.
12. Click **ASCII Set-Up**.

    The ASCII Set-Up dialog box appears.
13. Ensure that the settings are as follows:
    - ❑ Line delay – **0 milliseconds**
    - ❑ Character delay – **0 milliseconds**
    - ❑ ASCII Receiving – **Wrap lines that exceed terminal width**

    The cursor begins blinking.
14. Type some simple commands:
    - ❑ ?LEAK
    - ❑ ?ALL
    - ❑ ?SETUP

A.2.2 Printing with HyperTerminal

The easiest way to print information captured in HyperTerminal is to choose Print from the File menu; however, this method only prints information currently displayed on the screen. Screen information can also be highlighted, copied and pasted into Microsoft Word or Excel.

To capture large amounts of data that exceeds the terminal screen limits, use the Transfer menu Capture Text option:

1. Select *Transfer > Capture text*.

   The Capture text dialog box appears.

2. Click **Browse**.

   The Select Capture File dialog box appears.

3. Navigate to a location, enter a file name and select a file type:

   - ❑ .txt text file (Notepad)
   - ❑ .doc (Word)
   - ❑ .xls (Excel)

4. Click **Save**.

   The Capture Text dialog box reappears.

5. Click **Start** to log data.
6. Select *Transfer > Capture Text > Stop* to end text capture.
7. Open the file where the data was stored and select *File > Print*.

Example

To use the above procedures to poll the leak detector leak rate using HyperTerminal and capture the text:

1. Type the command: **XYZZY**.

   If received correctly, the leak detector responds *ok*.

2. Type the command: *?***LEAK 1 SECS CR ?ESC**.

   This command polls the leak rate every second. The time is set in seconds.

3. Press **ESC** to abort polling.
4. Select *Transfer > Capture Text*.
5. Browse to a folder and file using the Capture Text dialog box and click **Start**.
6. Select *Transfer > Capture Text > Stop* to abort data logging.

Table A-1 lists inquiries that are used to determine internal operating parameters. All inquiries, except VER, begin with **?** and end with <CR>.

Table A-1 Internal Operating Parameters

Inquiry	Response
?ALL	Responds with four lines. Each begins with a <cr><lf>. The first line reports the ion chamber value. The second line reports the emission value. The third line reports the value of the offset variable. The fourth line reports the gain value.
?AZ<0	Reports the status of the Auto-zero < 0 function, ON or OFF.
?CALOK	Reports the status of the last calibration.
?CL-XFER	Reports the currently stored contra-flow mode crossover pressure.
?CPLOCKOUT	Reports the status of the control panel lockout feature, ON or OFF.
?CURRDATE	Reports the current system date and time in the following format: 3 05/25/2005 04:19:03.35 1 where 3 is the day of the week (0 = Sunday, 1 = Monday, etc), 05/25/2005 is mm/dd/yyyy (date), 04:19:03.35 is hh/mm/ss/ms (time) and 1 is PM (0=AM, 1=PM, 2=24 hour).
?DISPLAY	Reports what the display bar graph is set to, *log* or *lin*.
?EMISSION	Reports the emission value.
?EXPONENT	Reports the current manual-mode exponent with a two-character (minus followed by one digit) number. The exponent is within the least sensitive range (as reported by ?RANGE) and the three lower (more negative exponent) ranges. See also INIT-EXPONENT.
?EXTLEAK	Reports the currently stored value of the external standard leak.
?GAIN	Reports the system gain value by returning a three-character number consisting of a two-digit gain factor with a decimal point after the first digit.
?INTEXT	Indicates which leak, Internal or External has been selected for use during calibration.
?IONCHAMBER	Reports the ion chamber value.
?LANGUAGE	Reports the language that has been selected to display on the front panel (0=English, 1=French, 2=German, 3=Korean, 4=Spanish, 5=Japanese, 6=Chinese).
?LEAK	Reports a six-character number consisting of a two-digit leak rate mantissa with decimal point after the first digit followed by E - then a two digit number, which is the leak rate range exponent (e.g., 1.3E-08).
?LKEXPIRE	Reports the internal calibrated leak expiration date mm/dd/yyyy.

Table A-1 Internal Operating Parameters (Continued)

Inquiry	Response
?LEAKTEMP	Reports the internal calibrated leak temperature that the factory calibration was performed at (degrees C).
?LP	Reports the current leak rate along with the test port and system pressures.
?LPV	Reports the current Leak Rate, Pressures and Valve state.
?ML-XFER	Reports the current contra to midstage crossover pressure setpoint in Torr. The response is in exponential format (in Torr): X.XE-XX
?PRESSURES	Reports two lines. Each begins with a <cr><lf>. The first line consists of the words *test port TC* followed by a number in mTorr. The second line consists of the words system TC followed by a number in uTorr.
?PWDONOFF	Reports status of system password (ON or OFF).
?QUICK-CAL	Reports whether Fast or Full Calibration is chosen if a calibration were to be started.
?RANGESTOP	Reports the value of the Range Stop variable.
?REJECT	Reports the reject leak rate setpoint (e.g., 7.0E-05) (where x is a number from 1 to 4 or the letter A).
?>xREJECT	Reports the status of a reject set point (where x is a number from 1 to 4 or the letter A).
?xREJECT	Reports the reject leak rate setpoint (e.g., 7.0E-05) (where x is a number from 1 to 4 or the letter A).
?ROUGH	Reports the currently stored Test Sequencer rough time used as part of setting up the Auto Sequencer.
?RSONOFF	Reports the status of the Rangestop function as Enabled or Disabled.
?SEQONOFF	Reports the status of the Auto Sequencer as Enabled or Disabled.
?SETUP	Reports seven lines, each begins with a <cr><lf>. The first line reports the turbo pump speed with the RPM value or OFF. The second line reports the selected manual leak rate range, and the ranging method as auto or manual. The third line reports the least sensitive leak rate range. The fourth line reports the reject set point leak rate. The fifth line reports the internal calibrated leak rate value. The sixth line reports the DAC output method as Linear, Log(2V), or Log(3V). The seventh line reports the active filament status as *One* or *Two,* followed by *Lit* or *Out*.
?SPLITFLOW	Returns the status of the split flow function, ON or OFF.

Table A-1 Internal Operating Parameters (Continued)

Inquiry	Response
?STDLEAK	Reports a six-character number consisting of a two-digit calibration standard leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit exponent (e.g., 1.3E-07). This inquiry is used for reporting the calibration standard leak rate entered using INIT-STDLEAK.
?SYSLEAK	Reports the leak rate value that has been stored that relates to the split flow functionality.
?SYSPWD	Reports the value of the system password.
?TEST	Reports the currently stored Test Sequencer test time used as part of setting up the Auto Sequencer.
?TEMPFACTOR	Reports the internal calibrated leak temperature factor that is used as part of the temperature correction logic (degrees C).
?TURBO	Reports four lines, each begins with a <cr><lf>. The first line consists of the word *turbo* followed by either READY or NOT READY. The second line consists of the word *turbo* followed by *either Fault* or *No Fault*. The third line consists of the words *turbo speed RPM* followed by the RPM value: xxxxx. The fourth line consists of the words "Turbo Temp (Celsius):" followed by the bearing temperature value: XX.
?VALVESTATE	Reports the current mode of the valves: Vent, Hold, etc.
VER	Reports the CPU software version in the form LC02.05 followed by a six digit hexadecimal checksum.
?VOLUMEONOFF	Reports audio as either ON or OFF.
WHYNOCAL	Reports the calibration failure diagnostics.
?0ENABLE	Responds with the status of the *Zero Enable* function, ON or OFF.

The commands listed in Table A-2 are used to set *non-volatile* operating parameters. The current value of the operating parameter is changed to the new value. If the leak detector is in back panel control, the response is *cant*.

Table A-2 Non-Volatile Operating Parameters

Command	Parameter
INIT-AZ<0	Preceded by 0 or 1, sets the status of Auto-zero < 0. 0 = off, 1 = on.
INIT-CL-XFER	Preceded by *X.XE-X*, sets the value of the contra-flow mode crossover pressure in Torr.

Table A-2 Non-Volatile Operating Parameters (Continued)

Command	Parameter
INIT-CPLOCKOUT	Sets the status of the control panel lockout. Preceded by (0) or (1), 0 = OFF, 1 = ON.
INIT-DATE	Sets the system date and time. Preceded by: dow, mm dd yyyy hh mm ss AmPm 24-12 mode, Where 2 is the day of the week (dow) (0 = Sunday, 1 = Monday, etc), mm/dd/yyyy (date), hh:mm:ss (time) AmPm (0=AM, 1=PM)24-12 mode (0 for 24 hr, 1 for 12 hr). Examples: 2 02 12 2005 04 16 33 1 0 INIT-DATE(Tuesday, February 12, 2005, 4:16:33 on a 24 hr clock)2 02 12 2005 04 16 33 1 1 INIT-DATE(Tuesday, February 12, 2005, 4:16:33 PM)?CURRDATE reports the stored value
INIT-DISPLAY	Sets the status of the bar graph display to either a log or linear display. Preceded by (1) Log or (0) Linear.
INIT-EMISSION	Sets the emission of the ion source. Preceded by a three-digit number (micro-amps), in the range 60 to 165.
INIT-EXPONENT	Sets the range that the leak detector will operate in when Manual Range is ON. Preceded by 0 to -11.
INIT-EXTLEAK	Sets the value of the external leak. Preceded by a two-digit leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit leak range exponent: the helium leak rate number in atm cc/sec of the calibration standard leak. Example: 3.2E-08 INIT-EXTLEAK
INIT-FILAMENT	Sets the operating filament in the ion source. Preceded by a single digit, either 1 or 2.
INIT-GAIN	Sets the value of the gain used for adjusting the helium signal to match a calibration standard leak. Preceded by a two-digit number with a decimal point after the first digit, in the range 1.0 to 6.0. **Note:** Changing Gain changes Zero by the same ratio.
INIT-ION	Sets the ion voltage of the ion source. Preceded by a three-digit number (volts) in the range 220 to 280.
INIT-LANGUAGE	Selects the language to be shown on the display. Preceded by 0-6 where (0=English, 1=French, 2=German, 3=Korean, 4=Spanish, 5=Japanese, 6=Chinese).
INIT-LINEAR	Sets the leak rate analog output voltage to Linear. Not preceded by a value.
INIT-LKEXPIRE	Sets the date on which the internal calibrated leak expires. Preceded by the date. Example: mm dd yyyy INIT-LKEXPIRE

Table A-2 Non-Volatile Operating Parameters (Continued)

Command	Parameter
INIT-LEAKTEMP	Sets the internal calibrated leak temperature (printed on the leak label) that the factory calibration was performed at. Preceded by 12.0 to 50.0 (degrees C). Example: 23.5 INIT-LEAKTEMP
INIT-1LOG	Sets the leak rate analog output voltage to logarithmic at 1 volt per decade. Not preceded by a value.
INIT-ML-XFER	Sets the value of the midstage-flow mode crossover pressure in Torr. Preceded by X.XE-XX. The range is 1.0E-03 to 1.0E-01 Torr. The default is 1.0E-01 (100 mTorr).
INIT-PASSWORD	Sets the system password. Preceded by a 1 to 6 digit password and followed by a digit indicating the number of digits in the password. Example: 123123 6 INIT-PASSWORD. Password is read back using the ?SYSPWD command.
INIT-QUICK-CAL	Sets which type of calibration will be run if the CALIBRATE command is initiated. Preceded by 0 or 1, 0 for FULL cal, 1 for FAST cal.
INIT-RANGESTOP	Sets the value of the most sensitive range exponent. Preceded by XX.
INIT-1REJECT	Sets the leak rate value for Reject Set Point #1. Preceded by a two-digit leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit leak range exponent, the helium leak rate number is in atm cc/sec. Example 3.4E-08 INIT-1REJECT
INIT-2REJECT	Same as INIT-1REJECT, but for Reject Set Point #2.
INIT-3REJECT	Same as INIT-1REJECT, but for Reject Set Point #3.
INIT-4REJECT	Sets the test port pressure value for Reject Set Point #4. Preceded by a two-digit leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit exponent: the test port TC pressure in millitorr. Example 1.5E-02 INIT-4REJECT
INIT-AREJECT	Same as INIT-1REJECT, but for the Audio Reject Set Point.
HIGH-xREJECT	Sets the reject set point to activate when the actual test value is higher than the set point. Where x is a number from 1 to 4 or the letter A. For example, the reject set point is set for 7.0E-05 and the actual test value is 9.2E-05.
LOW-xREJECT	Sets the reject set point to activate when the actual test value is lower than the set point. Where x is a number from 1 to 4 or the letter A. For example, the reject set point is set for 7.0E-05 and the actual test value is 4.3E-07.

Table A-2 Non-Volatile Operating Parameters (Continued)

Command	Parameter
INIT-ROUGH	Sets the Auto Sequencer rough time in seconds. Preceded by *XX*.
INIT-SYSLEAK	Sets the split flow leak value, system must be in TEST and the split flow feature must be OFF when this parameter is set. Preceded by a two-digit leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit leak range exponent: the helium leak rate number in atm cc/sec. Example 3.4E-08 INIT-SYSLEAK.
INIT-STDLEAK	Sets the value of the internal leak. Preceded by a two-digit leak rate mantissa with a decimal point after the first digit followed by *E-*, and then by a two-digit leak range exponent: the helium leak rate number in atm cc/sec. Example: 3.2E-08 INIT-STDLEAK.
INIT-TCTPZERO	Used to calibrate the low-pressure end of the test port thermocouple to a known pressure higher than zero. Preceded by a number (*XX*) of mTorr representing the test port pressure at the time of the command.
INIT-TEMPFACTOR	Sets the temperature correction factor that is printed on the internal calibrated leak label. Preceded by –10 to +10. Example: -7 INIT-TEMPFACTOR
INIT-TEST	Sets the Auto Sequencer test time in seconds. Preceded by *XX*.
LOCK-MS	Enables the MS lock feature. If the system exceeds 150 mTorr, the system goes from Fine test directly into Roughing mode (no Contra mode). If the leak rate exceeds the 7 range, the over range symbol appears.
UNLOCK-MS	Disables the MS lock feature.
?MS-LOCK	Queries the status of the MS lock feature; either *on* or *off* appears.

The commands listed in Table A-3 are used to cause an immediate change in the spectrometer operating parameters. *These Commands Do Not Change The Non-Volatile Operating Parameters.*

Table A-3 Spectrometer Operating Parameters

Command	Parameter
PUT-EXPONENT	Sets the exponent leak range for Manual mode. Preceded by a two-character number Acceptable values are 0 through -10.

Table A-3 Spectrometer Operating Parameters (Continued)

Command	Parameter
PUT-ION	Sets the ion value of the ion source. Preceded by a three-digit number of volts, in the range 200 to 350.
PUT-RANGESTOP	Sets the Range Stop exponent. Preceded by two or three characters *-XX* or *-X*.

The commands listed in Table A-4 are used to cause certain leak detection actions.

Table A-4 Leak Detection Actions

Command	Action
AUTO	Initiates auto-ranging mode. Success is indicated by the normal *ok* response.
CALIBRATE	Initiates a Full or Fast calibration depending on system settings. The CPU software tunes, then adjusts the gain so that the current helium signal causes the current leak rate measurement to be the same as the most recently input using INIT-STDLEAK. If the gain is 2.9 or higher, a normal calibration is performed. Success is indicated by the normal *ok* response.
DECREMENT	Subtracts 1 from the Manual Ranging leak rate exponent (making it more negative). Success is indicated by the normal *ok* response. Does nothing in auto-ranging mode. Does nothing upon reaching the most sensitive range.
DISABLE-0ENABLE	Turns the Zero Enable function OFF.
DISABLE-PASSWORD	Turns the password function OFF.
DISABLE-xREJECT	Turns the Reject Set Point OFF. Where x is a number from 1 to 4 or the letter A.
DISABLE-RANGESTOP	Turns the Range Stop function OFF.
DISABLE-SEQUENCER	Turns the auto sequencer function OFF.
DISABLE-SPLIFLOW	Turns the split flow function OFF.
DISABLE-VOLUME	Turns audio OFF.
ENABLE-0ENABLE	Turns the Zero Enable function ON.
ENABLE-PASSWORD	Turns the Password feature ON.
ENABLE-xREJECT	Turns the Reject Set Point ON. Where x is a number from 1 to 4 or the letter A.
ENABLE-RANGESTOP	Turns the Range Stop function ON.
ENABLE-SEQUENCER	Turns the auto sequencer function ON.

Table A-4 Leak Detection Actions (Continued)

Command	Action
ENABLE-SPLITFLOW	Turns the split flow function ON.
ENABLE-VOLUME	Turns audio ON.
EXTERNAL	Sets the External Calibrated Leak (in test port) as the leak for use during calibration.
INCREMENT	Adds 1 to the Manual Ranging leak rate exponent (making it less negative). Success is indicated by the normal *ok* response. Does nothing in auto-ranging mode. Does nothing upon reaching the least sensitive range.
INTERNAL	Sets the Internal Calibrated Leak as the leak to be used during calibration.
KEEP	Causes the leak detector to close most valves and enter the Hold state.
MANUAL	Turns the Manual Ranging Mode ON. Success is indicated by the normal *ok* response.
NOSNIFF	Turns the HIGH PRESSURE TEST function OFF.
ROUGH	Causes the leak detector to begin a roughing on the test port only.
SNIFF	Turns the HIGH PRESSURE TEST mode ON.
STDLEAK	Turns Read Std Leak ON/OFF. Verifies calibration by exposing internal cal leak to the system.
TPTCATM	Sets the current test port thermocouple reading to represent atmospheric pressure when the test port is exposed to atmosphere. Success is indicated by the normal *ok* response.
TPTCZERO	Sets the current test port thermocouple reading to represent a ZREO pressure reading when the test port pressure is less than 1.0E-04 Torr. Success is indicated by the normal *ok* response.
TUNE	Adjusts the ion source voltage to cause a maximum response to helium.
VENT	Causes the leak detector to isolate and vent the test port to the atmosphere.
XYZZY	Unlocks the system so that all RS-232 commands are accessible.
ZERO	Sets the current leak rate measurement to be 0.0 atm cc/sec in the most sensitive range.

A.3 Customer Accessible Inputs and Outputs

A.3.1 Serial Connector

Use the *SERIAL* connector on the Rear Panel to interface the VS Series leak detector to a PC via an isolated RS-232 connection. Table A-5 and Figure A-1 provide details of the connection. A typical connection from a 9-pin PC serial connector requires a female-to-female, 9-pin, null modem cable, where pins 2 and 3 are crossed.

Table A-5 Serial Connector Summary

Pin	EIA Name	Description
2	Received Data	Data into the leak detector
3	Transmit Data	Data out of the leak detector
5	Signal Common	RS-232 Ground

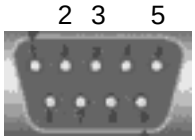

Figure A-1 Serial Connector Map

A.3.2 I/O Connector

Table A-6 lists the optional discrete I/O PCB (P/N# R2111501) pin signals. This I/O connector provides a means for a controller, usually a PLC, to control or to determine the leak detector status. The I/O is accessible via a type DB25S (female socket) connector.

Table A-6 I/O Connector Pin Signals

Pin No.	Signal Name	I/O	Signal	Description	Leak Detector Behavior
15, 19, 23	+ VIN	N/A	+5 V to +24 VDC	Customer-supplied +5VDC to + 24VDC for Output Common pins.	
17, 21	VRET	N/A	0 VDC	Customer -supplied GND for the Input Common pins.	
1	CAL_OUT	O	Level	Active HIGH when the leak detector is in CALIBRATION mode.	Performs calibrating routine with the Internal Calibrated Leak; Zeroing routine is included.

Table A-6 I/O Connector Pin Signals (Continued)

Pin No.	Signal Name	I/O	Signal	Description	Leak Detector Behavior
2	ZERO_OUT	O	Level	Active HIGH when the leak detector is in ZEROING mode.	Performs the Zeroing routine.
3	HOLD_OUT	O	Level	Active HIGH when the leak detector is in HOLD mode.	Performs a HOLD routine and isolates the test port and any test objects from the leak detector vacuum system.
4	VENT_OUT	O	Level	Active HIGH when the leak detector is VENT mode.	Performs a VENT routine, isolates the test port from the leak detector vacuum system and vents the test port to atmosphere.
5	START_OUT	O	Level	Active HIGH when the leak detector is in START/ROUGH mode.	Performs a ROUGHING routine on the test port and any attached test objects.
6	READY_ OUT	O	Level	Active HIGH when the leak detector is in READY mode.	Indicates that the leak detector is completing a STARTING routine and that the filament and turbo are OK.
7	TEST_OUT	O	Level	Active HIGH when the leak detector is in FINE TEST mode.	Indicates that the leak detector is ready for fine leak testing.
8	REJECT1_ OUT	O	Level	Active HIGH when the leak rate is over set point #1.	Indicates that the value of the leak rate exceeds the value set in the 1REJECT variable.
9	REJECT2_ OUT	O	Level	Active HIGH when the leak rate is over set point #2.	Indicates that the value of the leak rate exceeds the value set in the 2REJECT variable.
10	REJECT3_ OUT	O	Level	Active HIGH when the leak rate is over set point #3.	Indicates that the value of the leak rate exceeds the value set in the 3REJECT variable.

Table A-6 I/O Connector Pin Signals (Continued)

Pin No.	Signal Name	I/O	Signal	Description	Leak Detector Behavior
11	REJECT4_ OUT	O	Level	Active HIGH when the test port pressure is over set point #4.	Indicates that the value of the test port pressure exceeds the value set in the 4REJECT variable.
12	CAL_OUT_ OK	O	Level	Active HIGH when calibration is successful.	Indicates the calibration has successfully completed. Set low on power-up or if calibration is not successfully completed.
13	AUTO_ MANUAL_ RANGE_IN	I	Level	Active HIGH when Manual Ranging is selected.	Activation causes the leak detector to change from AUTO to MANUAL ranging ; Default is AUTO.
14	CAL_IN	I	> 200 ms Pulse	Active HIGH pulse.	Initiate CALIBRATING routine with Internal Calibrated Leak; Zeroing routine is included.
16	ZERO_IN	I	> 200 ms Pulse	Active HIGH pulse.	Initiate ZEROING routine.
18	HOLD_IN	I	> 200 ms Pulse	Active HIGH pulse.	Initiate HOLD routine and isolate the test port and any test objects from leak detector vacuum system.
20	VENT_IN	I	> 200 ms Pulse	Active HIGH pulse.	Initiate VENT routine and vent the test port to atmosphere.
22	TEST_IN	I	> 200 ms Pulse	Active HIGH pulse.	Initiate ROUGHING routine on the test port and any attached test objects.

Table A-6 I/O Connector Pin Signals (Continued)

Pin No.	Signal Name	I/O	Signal	Description	Leak Detector Behavior
24	RDSTDLK_ IN	I	Level	Active HIGH when standard leak is ON.	Initiate the INTERNAL STANDARD LEAK reading routine.
25	PARALLEL_ ENABLE_IN	I	Level	Active HIGH when ENABLE is active.	Activation causes the leak detector to take inputs only from the rear panel I/O or RS-232 port. No control functions (inputs) from the front panel or wireless are allowed.

Figure A-2 shows the output circuit sketch. Level outputs are optically isolated emitter followers with 10 Ohm series resistors, and a 14 mA max drive current (24 VDC max).

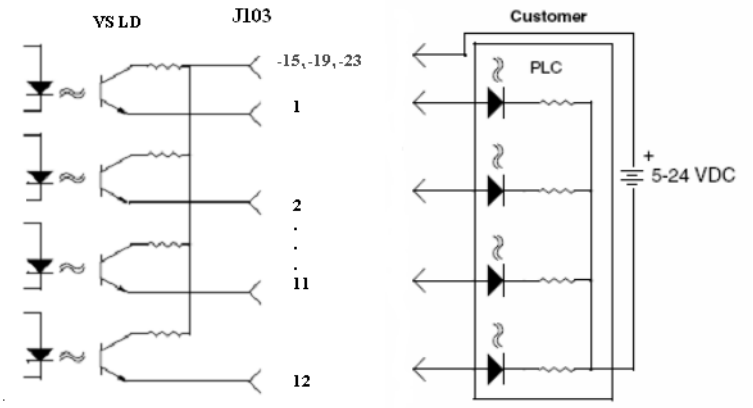

Figure A-2 Optically Isolated Output Circuit Sketch

Figure A-3 shows the input circuit sketch. All inputs are optically isolated 3300 Ohm resistive loads in series with the LEDs of the opto-isolators and voltage level from +5 VDC to +24 VDC. The required pulse inputs are 200 ms minimum pulse width.

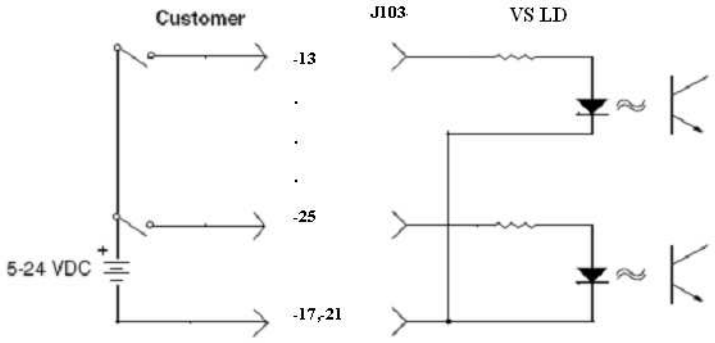

Figure A-3 Optically Isolated Input Circuit Sketch

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Appendix B. Leak Detector Spare Parts and Accessories Lists

Table B-1 Spare Parts

Item	Part Number
VS Series Remote, Base Unit (Field Installation):	VSFLDWB
❑ Wireless Baseboard Assembly (Qty: 1)	R2541301
❑ Label, Wireless Remote Control Base (Qty: 1)	R2778001
❑ Cable, RS-232, Wireless Base (Qty: 1)	R2552301
❑ Antenna, # S181FL-4-RMM-2450S (Qty: 1)	648751010
❑ Screw, SEMS, M3 X 6lg Pan HD Phillips (Qty: 4)	614418306
❑ Ion Source Field Replacement (w/o filaments)	VSFLDIS
❑ Testport TC Cable	VSFLDOC
VS I/O Kit (Field Installation):	VSFLDIO
❑ I/O Assembly (Qty: 1)	R2988301
❑ Cable, Discrete I/O, RS-232, Yellow (Qty: 1)	R2128301
2-Way Valve Assembly (V1, V2, V3, V4, V5 and V7)	R2010301
3-Way Valve Assembly (V6 and V8 (PR02))	R2011301
Spectrometer Assembly	R2041301
Replacement Fan Assembly	VSFLDFN
Motherboard PCB	R2101301
CPU PCB	R2361303
Ion Source PCB	R2120301
Valve Driver PCB	R2104301
24 VDC Turbo Controller PCB	9699518
Front Panel Controller PCB	R2117301
Front Panel Sub-Assembly	R2021301
AC-DC Power Supply	659077040
Filament Replacement	VSFLDFR
Valve Block O-ring Kit	VSFLDOV

Table B-1 Spare Parts (Continued)

Item	Part Number
Diaphragm Pump (PD03)	VSFLDDP
Diaphragm Kit (PD03)	614911041
Clippard Valve (PD03 and PR02)*	VSFLDV9
Exhaust Valve (2-way for PD03)	VSFLDV8
Fan Kit	VSFLDFN
Metal Gasket Kit	VSFLDMG
Discrete I/O PCB	R2111501
Wireless Base PCB	R2541301
Calibrated Leak	VSFLDCL
TC Replacement Kit	VS531A1S
TC 531 1/8" NPT	F072301

* For PR02 units manufactured after Spring 2009.

Table B-2 Leak Detector Accessory Item List

Assembly	Part Number
Flapper Box, NW25 Flange	L6241302
Power Probe, 10’ (NW25 Flange)	K9565306
Power Probe, 25’ (NW25 Flange)	K9565307
Spare Tip Filters for Power Probe (Qty: 10)	K9565303
Throttle Valve (NW25 Flange)	R1947301
Elite-Z Mechanical Pump Fluid	695409005
Calibrated Leak, 10^{-5}, 10^{-6} (NW25 Flange)	F8473320
Calibrated Leak, 10^{-7} (NW25 Flange)	F8473321
Calibrated Leak, 10^{-8} (NW25 Flange)	F8473322
Calibrated Leak, 10^{-9} (NW25 Flange)	F8473323
Calibrated Leak, 10^{-10} (NW25 Flange)	F8473324
Oil Mist Eliminator	VSFLDME
Filter, Oil Mist Eliminator	649071021
Inlet Adapter Kit (NW25-1-1/8” Compression)	VSFLDCP

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Appendix C. VS Series Leak Detector Hardware Descriptions

The VS Series Helium Mass Spectrometer Leak Detector system hardware locates and measures the partial pressure of helium that is proportional to the desired Helium leakage flow rate in a vacuum system under full software control.

The VS Series leak detector hardware provides:

- ❑ Gas evacuation and high vacuum creation in the test port and spectrometer tube
- ❑ Helium detection and leak rate measurement
- ❑ Microprocessor-based software control of all leak detector functions, mode and operations such as:
  - ❑ Spectrometer tube electrode parameters
  - ❑ Leak rate analog-to-digital and digital-to-analog conversion, calculation and presentation via LCD Display, audio speaker, analog voltage and RS-232 outputs
  - ❑ Spectrometer and Test Port pressure measurement, calculation and presentation via the LCD display and RS-232 output
  - ❑ Valves control
  - ❑ Turbo molecular and mechanical pumps control
  - ❑ Front Panel control and indication
  - ❑ Discrete I/O reading and control
  - ❑ Wireless remote control
- ❑ AC-to- DC voltage supply conversion and distribution
- ❑ Protected AC power for the mechanical pumps

VS Series hardware resides in a stand-alone unit with a plastic enclosure compromised:

- ❑ Spectrometer tube sub-assembly with a pre-amplifier PCB
- ❑ Valve block sub-assembly with seven solenoids and Standard Calibrated Leak with a Temperature Sensor PCB
- ❑ Turbo molecular pump
- ❑ Internal mechanical pump with a valve (VS PR02 model only) and external 6 A circuit breaker or an AC 20 A outlet for the external mechanical wet or dry pumps.
- ❑ Electronics block sub-assembly with the CPU, Motherboard, Ion Source, Valve Driver and Turbo Controller PCBs
- ❑ Front Panel with the color LCD Display, Touch Panel and two hard keys (*TEST* and *VENT*)

- ❑ Discrete I/O PCB (optional)
- ❑ Wireless Base PCB with RF antenna (optional)
- ❑ Two fans
- ❑ AC Power Entry Module with the IEC60320, C20 input, 20 A thermal circuit breaker/ switch and EMI filter
- ❑ Universal Power supply with (100 –253) VAC, 50/60 Hz input and +24 VDC output

All VS Series leak detector hardware PCBs and sub-assemblies are interconnected using the cables shown in Appendix E “Interconnection Diagram” on page E-1.

C.1 Spectrometer Tube Description

The spectrometer tube is a heart of the VS Series Helium Mass Spectrometer Leak Detector and is quantitatively sensitive to the presence of helium.

The VS Series spectrometer tube:

- ❑ Creates positive ions from gas molecules that penetrate inside the spectrometer, maintained under high vacuum, via any leaks in the unit under test (UUT), which is connected to the test port
- ❑ Separates helium from all other gas ions, detects helium and total gas pressures as currents
- ❑ Converts the helium current into voltage with amplification.

The VS Series leak detector spectrometer tube is a stand-alone unit comprised of five sections:

- ❑ Spectrometer tube body with magnets
- ❑ Ion source with two filaments section
- ❑ Electro-magnetic ion lenses
- ❑ Electrometer section for the partial helium pressure signal
- ❑ Collector plate for the total pressure signal

C.2 Printed Circuit Boards P/Ns and Descriptions

This section describes the following circuit boards:

- ❑ Section C.2.1 “CPU PCB”
- ❑ Appendix C.2.2 “Motherboard PCB” on page C-4
- ❑ Appendix C.2.3 “Ion Source PCB” on page C-5
- ❑ Appendix C.2.4 “Valve Driver PCB” on page C-6
- ❑ Appendix C.2.5 “Turbo Controller PCB” on page C-6
- ❑ Appendix C.2.6 “Front Panel Controller PCB” on page C-7
- ❑ Appendix C.2.7 “Pre-Amp PCB” on page C-8
- ❑ Appendix C.2.8 “Temperature Sensor PCB” on page C-8
- ❑ Appendix C.2.9 “Discrete I/O PCB” on page C-9
- ❑ Appendix C.2.10 “WRC-B PCB” on page C-10
- ❑ Appendix C.2.11 “WRC_HH PCB” on page C-11

C.2.1 CPU PCB

The CPU PCB (Agilent P/N R2362303) is a modified version of a PC104-based single board Computer that functions as an embedded PC in the VS Series leak detector.

The CPU PCB circuitry provides:

- ❑ 32-bit, 16 MHz, integrated MC68332 microcontroller unit (MCU), which combines high-performance data manipulation capabilities with powerful peripheral subsystems
- ❑ Battery backed SRAM for frequently updated process parameters and real time clock/ calendar
- ❑ Flash Memory with boot sector
- ❑ EEPROM for setup and configuration parameters
- ❑ Non-isolated UART/RS-232 serial interface for communication with the external VS Series leak detector peripherals such as:
  - ❑ Front Panel PCB
  - ❑ Valve Driver PCB
  - ❑ Turbo Pump Controller PCB
  - ❑ Discrete I/O PCB
- ❑ Serial Interface for background debug mode (BDM)
- ❑ EEPLD control signals generation for the Motherboard PCB

- ESD protected PC104 Parallel Interface (Data, Address and Control) Bus for communication with the Ion Source and Preamp PCBs via the Motherboard PCB

The CPU circuitry resides on a stand-alone PC104 PCB comprised of six sections:

- MCU and memory (SRAM, FLASH and EEPROM) section
- Real Time Clock/Calendar section with the battery and super capacitor backup with 4-pin battery connector (JXBT) and IRQ1 jumper
- RS-232 section with 9-pin connector (J2); pin No. 10 is removed
- BDM section with 10-pin connector (J1)
- Time processor section with 34-pin connector (J4); not used in VS leak detector.
- Parallel interface section with two 64-pin, 0.1x0.1, PC-104 bus type I/O connectors (J3)

C.2.2 Motherboard PCB

The Motherboard PCB (Agilent P/N R2101301) functions as liaison between the CPU PCB and all other hardware section under full software control provided by CPU PCB

The Motherboard PCB circuitry provides:

- Parallel interface (Data, Address and Control) communication between a CPU and an Ion Source PCBs
- UART/RS-232 non–isolated parallel-to-serial and serial-to-parallel interface for the leak detector peripherals such as:
  - Front Panel PCB
  - Valve Driver PCB
  - Turbo Pump Controller PCB
  - Discrete I/O PCB
- RS-232 isolated serial communication between the CPU PCB and a rear panel serial diagnostic port
- Isolated leak rate analog output (0-10 VDC)
- Parallel-to-serial and serial-to-parallel communication between the Pre-amp ADC PCB and CPU PCB
- Test Port Thermocouple (TP TC) power supply and TP pressure voltage-to-frequency signal conversion
- Isolated calibrated leak temperature frequency signal conversion
- CLPD control signals generation, data-to-frequency and frequency-to-data conversion
- +24 VDC to a +5 VDC DC-DC conversion for the 5V-logic supply and clock/memory battery power back up.

The Motherboard circuitry resides on a stand-alone PCB comprised of five sections:

- ❑ Parallel interface section with two 64-pin, 0.1x0.1, PC-104 bus type I/O connectors (J1 and J2)
- ❑ Non-isolated quad UART/RS-232 section with four I/O, RJ45-8x8 connectors (J100A/B and J101A/B)
- ❑ TP TC gauge section with 4-pin I/O connector (J200)
- ❑ Isolated section that consists of analog output and RS-232 circuitry with 10-pin I/O connector (J300) and two I/O, RJ45-8x8 connectors (J302) and a calibrated leak temperature circuitry with 4-pin input connector (J301)
- ❑ Power Supply section with 3-pin connector (J400) and 4-pin connector (XJBT1)CPLD section with two 14-pin JTAG connectors (J501 and J502) and RJ45-10x10 connector (J500)

C.2.3 Ion Source PCB

The Ion Source PCB (Agilent P/N R2120301) creates the high voltage and filament current supply for all spectrometer tube electrodes under full software control provided by the CPU PCB.

The Ion Source PCB circuitry provides:

- ❑ Parallel interface (Data, Address and Control) communication between the Ion Source and CPU PCBs via the Motherboard PCB
- ❑ High voltage flyback power supplies for a spectrometer tube such as:
  - ❑ Filament Bias
  - ❑ Suppressor
  - ❑ Chamber/Repeller
- ❑ Filament power supply with an emission current regulation loop
- ❑ CLPD control signals generation
- ❑ Isolated digital control of the ion voltage (filament bias/repeller voltage) and emission current (filament voltage) tuning; the filament selecting (FIL 1_SEL and FIL2_SEL), high voltage supply (HV_ON/OFF) switching
- ❑ +24 VDC to a +5 VDC DC-DC conversion for the filament supply and +24 V to +15 V for the digital control circuitry

The Ion Source circuitry resides on a stand-alone PCB comprised of five sections:

- ❑ Parallel interface/CPLD section with a 64-pin, 0.1x0.1, PC-104 bus type I/O connector (J5) and a 14-pin JTAG connector (J2)
- ❑ High voltage section with the ion voltage tuning and a 10-pin connector (J4)

- ❑ Filament power supply section with the emission tuning and good emission (EMI-OK) signals generation
- ❑ Isolated digital control section
- ❑ Power supply section with 3-pin connector (J1)

C.2.4 Valve Driver PCB

The Valve Driver PCB (Agilent P/N R2104301) functions as PWM solenoid drivers under software control provided by the CPU PCB.

Valve Driver PCB circuitry provides:

- ❑ ± 50 V Isolated RS-232 interface with the CPU PCB via the Motherboard PCB
- ❑ Local microprocessor control and valve failure detection signals for eight solenoid valves
- ❑ Delayed pulse-width modulated (PWM) output voltage for the solenoid valves
- ❑ +24 VDC to a +5 VDC conversion for the 5 V-logic.

The Valve Driver circuitry resides on a stand-alone PCB comprised of three sections:

- ❑ Isolated I/O RS-232 interface section with a RJ45-8x8 connector (J1)
- ❑ Microcontroller and eight valve driver cells section with two 12-pin connectors (J3 and J4)
- ❑ Power supply with 3-pin connector (J2)

C.2.5 Turbo Controller PCB

Turbo V70 Controller PCB circuitry provides:

- ❑ RS-232 communication with the CPU PCB via the Motherboard PCB
- ❑ Local microprocessor-controlled 24 VDC-to- frequency conversion with auto-diagnostic (voltage, current and temperature control) and auto-protection (over current and temperature) functionality for turbo pump
- ❑ 3-phase variable output voltage, current and frequency control respect to the speed reached by the turbo pump
- ❑ +24 VDC to +5 VDC, +15 VDC, +12 VDC and +VP (~50 VDC) conversion

The Turbo V70 controller circuitry resides on a stand-alone PCB comprised of five sections:

- ❑ I/O RS-232 interface section with a 6-pin connector (P5)
- ❑ Microcontroller with an 8-channel ADC section with the temperature (ambient, turbo and heat sink), current and motor voltage sensors
- ❑ 3-phase motor driver section with over current protection and 6-pin connector (P2)
- ❑ Power supply section with 4-pin connector (P3)

- ❑ Parallel I/O section with 15-pin connector (P4) – not used in the VS Series leak detector.

C.2.6 Front Panel Controller PCB

The Front Panel PCB (Agilent P/N R2117301) functions as liaison between an operator and VS Series leak detector via an LCD display, Touch Panel and two hard keys (*TEST* and *VENT*) under software control provided by the CPU PCB.

The Front panel PCB circuitry provides:

- ❑ ± 50 V isolated RS-232 interface with the CPU PCB via the Motherboard PCB
- ❑ Non-isolated RS-232 interface with a Wireless Base PCB
- ❑ Microprocessor (CPU) control of the two UART, color TFT- LCD Display, Touch and Front Panels, LCD brightness and audio volume, PWM output for an audio circuitry, USB device functionality and temperature control
- ❑ Power amplification for the audio control
- ❑ CPLD control signal generation
- ❑ 24 VDC to +3.3 VDC, +12 VDC and +1.8 VDC conversion
- ❑ 24 VDC to 600 VAC conversion for a CCFL backlight of the LCD display

The Front Panel Controller PCB circuitry resides on a stand-alone PCB comprised of nine sections:

- ❑ CPU and memory (SDRAM and Flash) section
- ❑ Isolated I/O RS-232 interface section (UART1) with a RJ45-8x8 connector (J303)
- ❑ Non-isolated I/O RS-232 interface section (UART2) with a DB9 female connector (P300)
- ❑ USB device section with a USB B-type connector (J302)
- ❑ CPLD section with a 6-pin overlay connector (J503) and 14-pin CPLD JTAG connector (J500)
- ❑ Audio amplifier section with a 2-pin speaker connector J501
- ❑ TFT_LCD and Touch Panel interface section with a 33-pin display connector (J602), 4-pin touch panel connector (J601), and 20-pin debug connector (P602)
- ❑ Power supply section with 3-pin power connector (J401) and 5-pin backlight connector (J400)
- ❑ DC-AC daughter PCB with high voltage AC connector CN2

C.2.7 Pre-Amp PCB

The Pre-Amp PCB (Agilent P/N R2107301) functions as an ADC converter for the spectrometer tube helium and total pressure signals under full software control provided by the CPU PCB. The Pre-Amp PCB passes all voltages and currents to the ion source section of the spectrometer tube. The Pre-Amp PCB is soldered directly to a spectrometer tube header.

Pre-Amp PCB circuitry provides:

- ❑ Digital isolated serial interface with the Motherboard PCB
- ❑ 24-bit sigma-delta analog-to-digital conversion of the signals proportional to:
  - ❑ Helium leak rate generated by an electrometer amplifier in a spectrometer tube
  - ❑ Total (spectrometer tube) pressure generated by the ions of gasses heavier than helium, collected by an off-target collector plate and amplified by an active low pass filter stage
  - ❑ 24 VDC conversion to ± 15 VDC, ± 12 VDC (the electrometer supply), ± 5 VDC analog supply for the ADC converter, +5 VDC digital supply and 24 V/5 V DC-DC conversion for the electrometer Peltier cooler element inside of the spectrometer tube
  - ❑ Ion source's electrodes voltage supply distribution and filtering

The Pre-Amp PCB circuitry resides on a stand-alone PCB comprised of four sections:

- ❑ Digital isolated section with a RJ45-10x10 connector (JR1)
- ❑ ADC section with 8-pin spectrometer connector (J3)
- ❑ Power supply section
- ❑ Ion source's high voltage and high current distribution section with 10-pin connector (J1) and 6-pin spectrometer connector (J2)

C.2.8 Temperature Sensor PCB

The Temperature Sensor PCB (Agilent P/N R2114301) provides direct temperature –to-frequency conversion, where a period of the output square-wave 5 V-TTL signal is proportional to temperature. Further conversion to 16-bit digital signal is provided by a CPLD on the Motherboard PCB and sent to the CPU PCB via RS-232 port.

The Temperature circuitry resides on a stand-alone PCB directly placed on the Standard Calibrated Leak and comprised of an TMP03 integrated circuit and a 4-pin connector (J1).

C.2.9 Discrete I/O PCB

The Discrete I/O PCB (Agilent P/N R2111301) functions as liaison between the VS Series leak detector and the external devices, such as PLC and USB connected devices (PC, Printer, External Memory and/or Bar Code readers) in future releases. The USB section is non-functional. The Discrete I/O PCB is under full software control provided by the CPU PCB.

The Discrete I/O PCB circuitry provides:

- Local CPU and memory (SDRAM and Flash) for serial-to parallel (Address, Data and Control signals) conversion for the parallel I/Os and embedded USB Host controllers
- Parallel optically isolated input (7- lines) and Output (12-lines) interface between the VS leak detector and external equipment (e.g. PLC)
- RS-232 Isolated Serial communication interface with the CPU PCB via the Motherboard PCB
- Non-isolated USB interface for communication:
  - Upstream with a Front Panel Controller PCB (1-channel)
  - Downstream with the external USB devices (2-channels)
  - Downstream with communication with an external PC
  - +24 VDC to +5 VDC, +3.3 VDC and +1.8 VDC conversion
  - Flapper box interface

The Discrete I/O circuitry resides on a stand-alone PCB comprised of six sections:

- CPU and memory section
- Isolated RS-232 section (system site) with a RJ45-8x8 connector (J100)
- Isolated parallel interface section (customer site) with a 25-pin DB25 female type connector (J103)
- Flapper box interface section with a 6-pin connector (J102)
- Power supply section with a 3-pin connector (J101)
- Non-isolated USB section with:
  - Dual USB, type A, connectors (J201A and J201B) for the external USB devices
  - USB, type A, connectors (J202) for the Flat Panel PCB
  - USB, type B, connectors (J203) for the external PC

C.2.10 WRC-B PCB

The VS Series leak detector Wireless Remote Control (Agilent P/N R2541301) provides wireless communication between the leak detector and the hand-held remote control unit.

The Wireless Remote Base PCB circuitry provides:

- ❑ Isolated RS-232 serial interface for communication with the CPU PCB via the Front Panel PCB
- ❑ Serial/parallel interface for communication with a 2.4 GHz transceiver module
- ❑ RF output for communication with an omni-directional dipole antenna via a coax cable
- ❑ Voltage-to-frequency conversion of RF strength signal
- ❑ 24 VDC-to +5 VDC conversion.

The Wireless Remote Base circuitry resides on a stand-alone PCB comprised of five sections:

- ❑ Isolated RS-232 serial interface and V/F converter with a 9-pin DB9 female type connector (P300)
- ❑ Serial/parallel interface with 20-pin connector (J2),
- ❑ 3-pin jumpers (J4-J6, J8 and J9) and 10-pin connector (J4)
- ❑ RF module with 20-pin interface connector and RF MMCX type connector
- ❑ Power supply section with 3-pin connector (J401)

C.2.11 WRC_HH PCB

The Wireless Remote HH PCB (Agilent P/N R2544301) circuitry provides:

- Local microprocessor for parallel communication with the RF 2.5GHz module, keypad, LCD Display and backlight LED
- RS-232 serial interface for software programming
- Leak rate audio indication
- Battery voltage to +5 VDC and +3.3 VDC conversion
- RF output for communication with an omni-directional dipole antenna via a coax cable

The Wireless Remote HH PCB circuitry resides on a stand-alone PCB comprised of five sections:

- Microcontroller Section with a BDM 10-pin connector (J4
- Keypad interface section with a 14-pin connector (J3)
- LCD display section
- Audio section with a 2-pin speaker connector and 3-pin audio jack connector (J7)
- Power supply section

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Appendix D. Troubleshooting

D.1 Start Up and Operational Failures

Main Power switch trips on power up

Causes/Resolutions

1. Foreline pump failure (MR15 and MD30 models only):
   a. Disconnect the foreline pump power cord from the back of the leak detector.
   b. Power up the leak detector and confirm the power switch does not trip.
   If it does not trip: Replace the foreline pump, due to a seizure or motor failure.
2. 24 V power supply failure (all models):
   a. Remove leak detector covers and disconnect power cable.
   b. Disconnect the AC input to the 24 VDC power supply (Figure D-1).

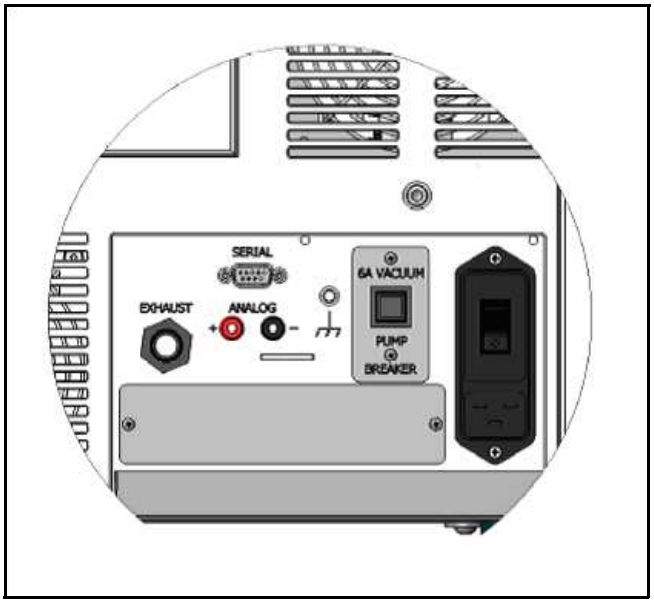

Figure D-1 VS Series Power and Communications Panel

   c. Power up the leak detector and confirm the power switch does not trip.

6 A vacuum pump breaker trips at startup

Causes/Resolutions

1. Operating temperature is less than 10 °C (50 °F). Mechanical pump oil is cold causing the motor to draw more current during power up:
   - ❑ Place the leak detector (PR02) in a warmer environment > 10 °C (50 °F) for one hour, preferably 22 °C (72 °F).
2. Defective mechanical pump (DS42 only):
   - ❑ Replace the mechanical pump (Figure D-2). Refer to Section 6 “Turbo Molecular Pump and Roughing/Foreline Pumps” for the correct procedure.
3. Defective scroll pump (IDP-3) - PD03 model. See Section 18 “Scroll Pump Replacement (PD03 only)”.

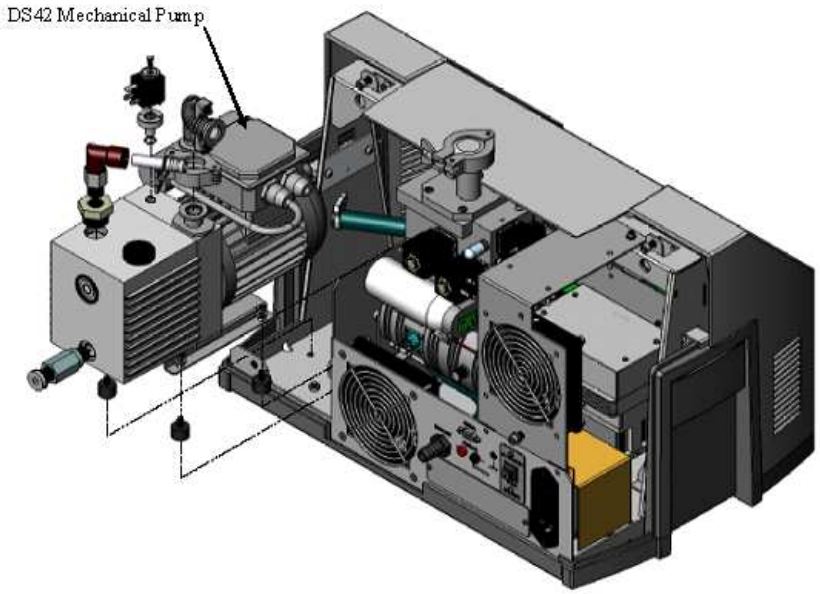

Figure D-2 DS42 Mechanical Pump Removal

Front panel display is blank after power up and mechanical pump is running

Causes/Resolutions

1. 24 V power supply is defective:
   - ❑ Remove leak detector covers and measure the output of the 24 V power supply (Figure D-3).

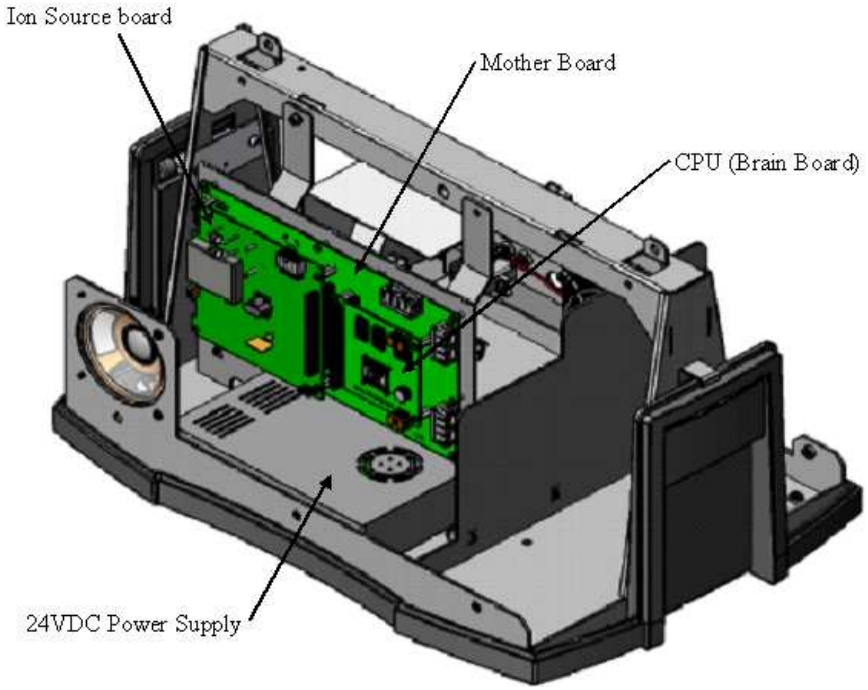

Figure D-3 Board Locations

2. Defective front panel display:
   - ❑ Ensure that the 24 VDC is available for the front panel display, if present, replace front display. 24 VDC can be measured at the P401 connector.

System Pressure Wait error message appears on the front panel display.

This error can also occur during normal operation.

Causes/Resolutions

1. Foreline pump is not running

   For the:

   - ❑ DS302 - Ensure the foreline pump is operating - check electrical connections and that the power switch is on.
   - ❑ PR02 and PD03 - Ensure the 6 A breaker (Figure D-1 on page D-1) is not off or tripped:

   a. Press **Vent**.

   b. Remove test port cap and press **Test** and verify that suction (vacuum) is present by placing hand over test port.

2. Foreline valve is not open:

   a. Verify if the valve error symbol is present.

   b. Open the *Manual Valve Control* screen and verify that the foreline valve indicates a failure (red circle- coil shorted or open).

   c. Remove covers and disconnect the V1 plug (Figure D-7 on page D-7) from the coil and measure the resistance of the coil (coil resistance = 10 Ohms).

   To attach the spectrometer to the turbo pump, the torque sequence is:

   - ❑ Finger tight all hardware in place.
   - ❑ Torque hardware pattern to 6.2 N-m (55 in-lb).
   - ❑ Re-torque hardware pattern to 12.4 N-m (110 in-lb).
   - ❑ Wait 5 minutes and re-torque hardware pattern to 12.4 N-m (110 in-lb).
   - ❑ Re-torque to 12.4 N-m (110 in-lb) three times at 5 minute intervals.

   d. Reconnect the V1 plug and verify operation (listen for activation) by toggling the foreline valve from the *Manual Valve Control* screen.

3. Valve Driver board failure:

   a. Press **Test** or **Vent** to verify correct operation.

   b. Select the *Manual Valve Control* screen; toggle the individual valves, and verify activation.

   c. Ensure the 24 V and communication cable between the valve driver PCB and motherboard are secure (Figure D-4).

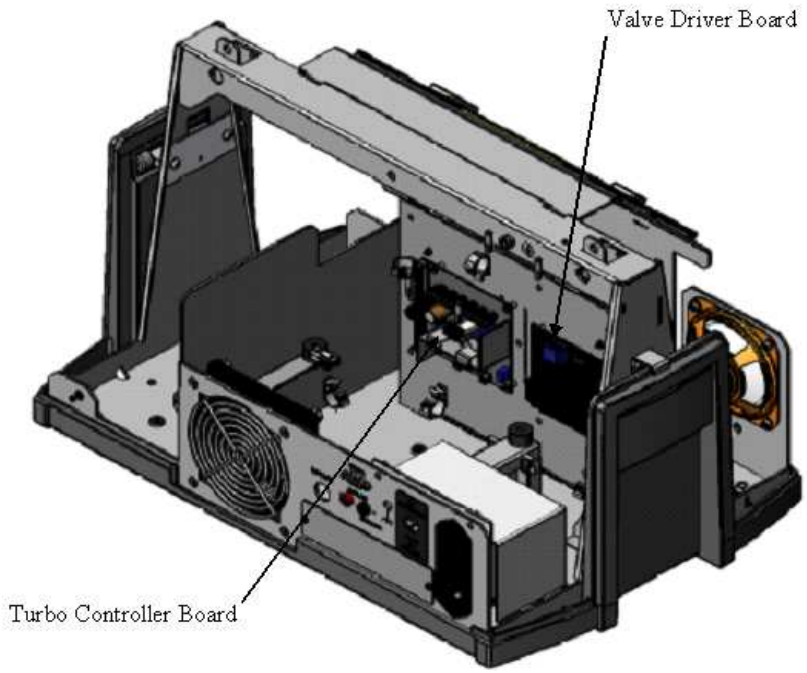

Figure D-4 Valve Driver and Turbo Controller Boards

d. Remove the connectors from V1 and V2 and place the V2 connector on V1 (Figure D-5). Open the *Manual Tuning* screen and toggle Contraflow on. Verify that the turbo RPM is increasing and ramps up to 69960 and return to the *Home* screen and verify the *System Pressure Wait* message is gone. V1 valve channel is defective; replace PCB (Figure D-4 on page D-5).

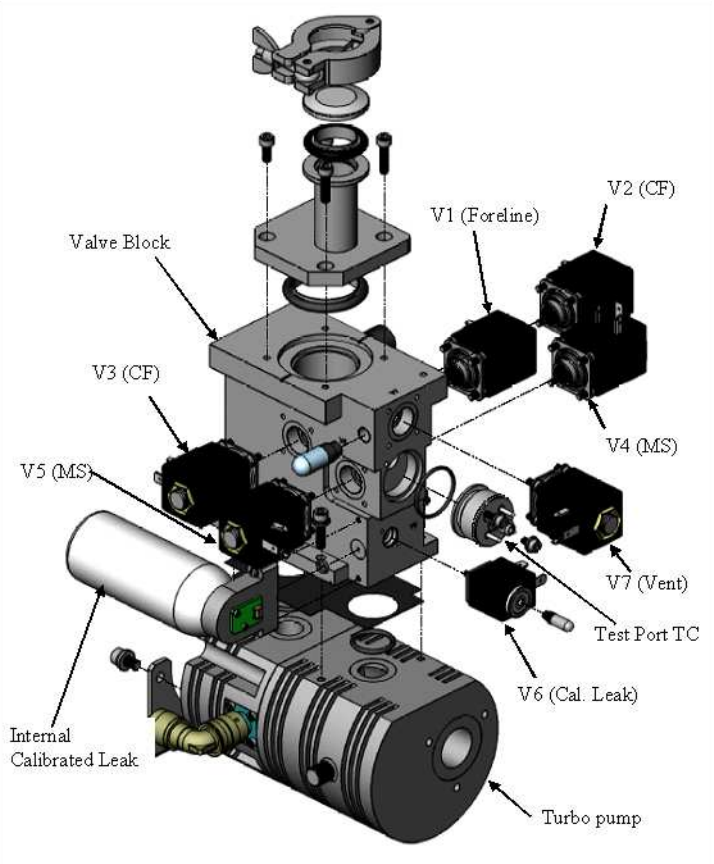

Figure D-5 Valve Block - Exploded View

4. VPI valve (Figure D-6) on TS620 scroll pump (MD30 only) is not open:

   If the scroll pump is running, press **Vent**, remove the test port cap and press Test and verify that suction (vacuum) is present by placing hand over test port. If no vacuum is present, the coil on the VPI valve is defective.

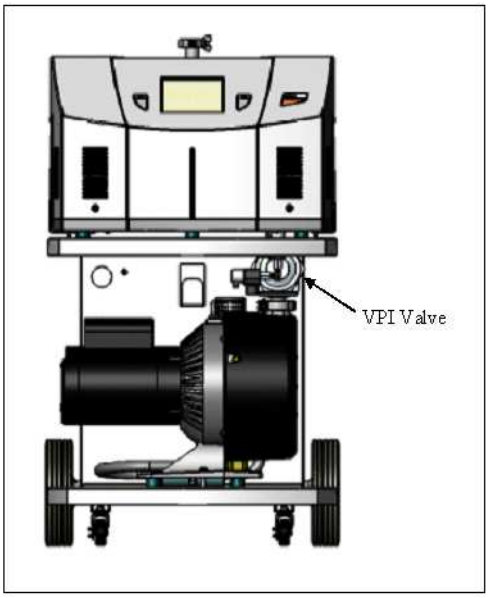

Figure D-6 VPI Valve

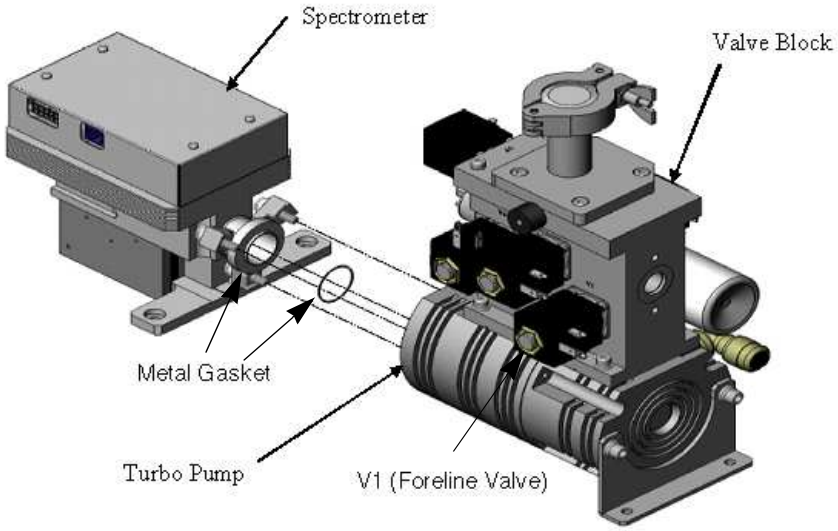

Figure D-7 Valve Block Spectrometer - Exploded View

5. Turbo pump failure:
   a. Verify that the red turbo symbol appears on the *Home* screen. This symbol flashes when a turbo failure is present.
   b. Select the *Manual Valve Control* screen and verify that the turbo RPM is 70K - 69960 RPM and that the bearing temperature is normal (< 50 °C (122 °F)). If the bearing temperature is > 60 °C, the turbo shuts down.

c. If no turbo error symbol is present on the *Home* screen, select the *Manual Valve Control* screen and observe the turbo RPM and bearing temperature. If the turbo RPM is 6000, it is possible that the turbo has crashed (Figure D-5 on page D-6):

- ❑ Remove the complete valve block assembly (valve block, turbo and spectrometer) from the leak detector.
- ❑ Remove the spectrometer (Figure D-4 on page D-5) from the turbo and see if the turbo spins freely. If not, replace turbo.

NOTE

Install the turbo pump using a new metal gasket and follow torque requirement instructions.

6. Turbo Controller board failure:

a. Verify that the red turbo symbol appears on the *Home* screen.

b. Open the *Manual Valve Control* screen and ensure that the turbo RPM = 0 and the bearing temperature = 255 °C (491 °F).

c. Verify that the power cable is connected to the turbo and that 24 VDC is present at the turbo controller board. If all connections are secure, replace the turbo controller board (Figure D-4 on page D-5).

d. Open the *Manual Valve Control* screen and ensure that the turbo RPM = 0 and the bearing temperature = 0 C (32 F). Ensure that the RS-232 cable is secure at the turbo controller board and motherboard. If the RS-232 cable is secure, replace the turbo controller board.
If the replacement turbo controller board does not solve the communication problem, there is a chance that the RS-232 cable is defective or that the communication port on the motherboard is not working, replace the motherboard (Figure D-3 on page D-3).

7. Gross leak in vacuum system:

- ❑ Ensure that the foreline connection (bellows) between the foreline pump and valve block are properly attached and free of cracks and fractures. If not, replace these.

Spec Tube message error appears on the front panel display

This error can also occur during normal operation.

Causes/Resolutions

1. Spectrometer pressure is >1E-4 due to a gross leak:

a. Select *Setup menu > Gauge Calibration* menu and ensure that the *Spectrometer Pressure* reading is < 1E-4 Torr.

b. Check for a gross leak at the turbo inlet, spectrometer inlet (gasket misaligned) or at the spectrometer header (gasket misaligned) or entire spectrometer (Figure D-4 on page D-5, Figure D-8 on page D-9 and Figure D-9 on page D-9).

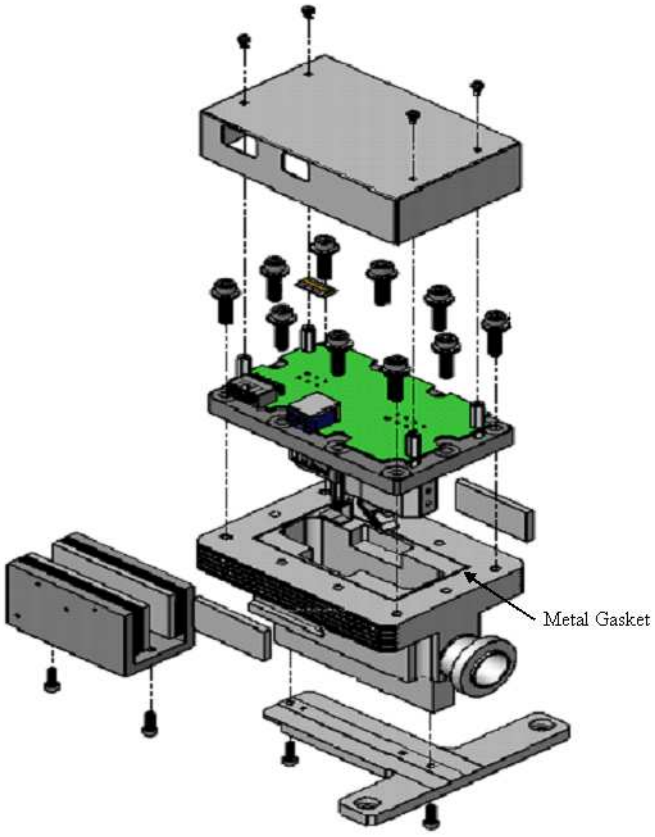

Figure D-8 Screws - Exploded View

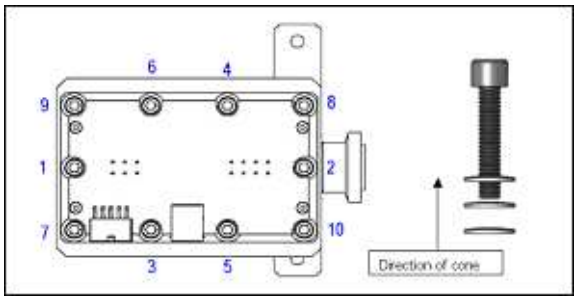

Figure D-9 Washer Alignment and Pattern

NOTE

Insert a screw with three Belleville washers into each hole and finger tight (Figure D-9).
Following the pattern shown in Figure D-9, torque screws to 5 N-m (45 in-lbs).
Re-torque hardware in pattern shown to 10.2 N-m (90 in-lbs).
Go through the entire torque pattern twice to ensure the metal gasket is firmly compressed.
Wait a minimum of five minutes then torque the pattern shown to 10.2 N-m (90 in-lbs).

2. Spectrometer pressure is >1E-4 due to a misaligned, incorrectly assembled or contaminated total pressure plate:

   a. Disassemble the spectrometer header from the spectrometer body and inspect the total pressure plate (Figure D-8 on page D-9, Figure D-10 and Figure D-11).

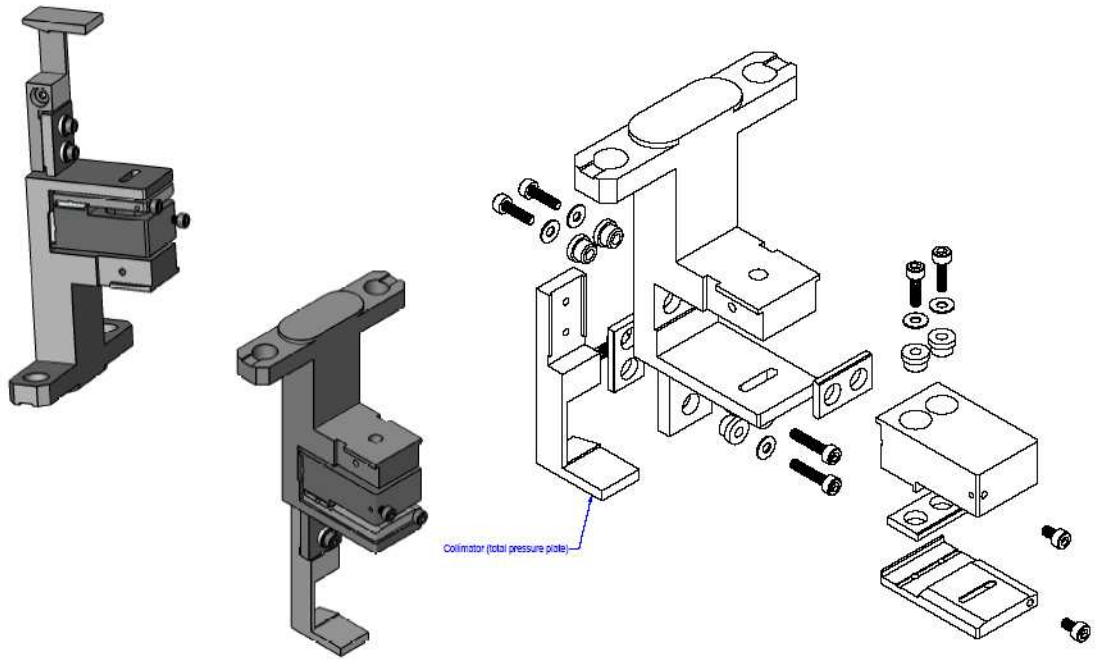

Figure D-10 Spectrometer (Ion Source Assembly)

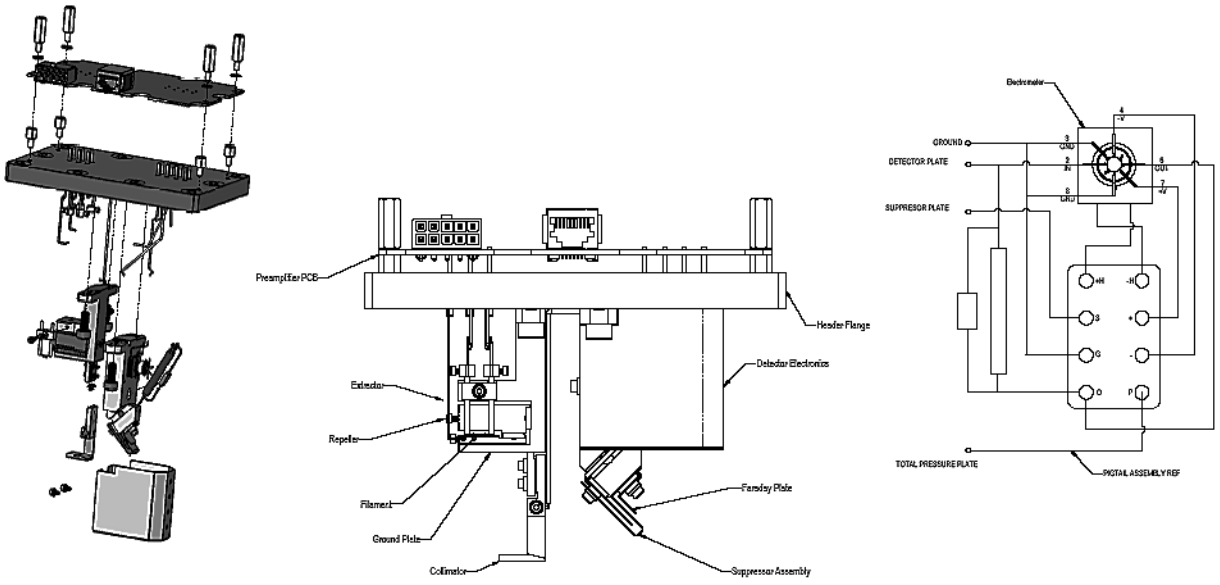

Figure D-11 Spectrometer Header: Decomposition

b. Ensure the total pressure plate is electrically isolated from ground and other points of contact.

c. Ensure that the total pressure plate wire is securely fastened to total pressure plate and feed through pin.

3. Pre-amp board failure (Figure D-11 and Figure D-12):

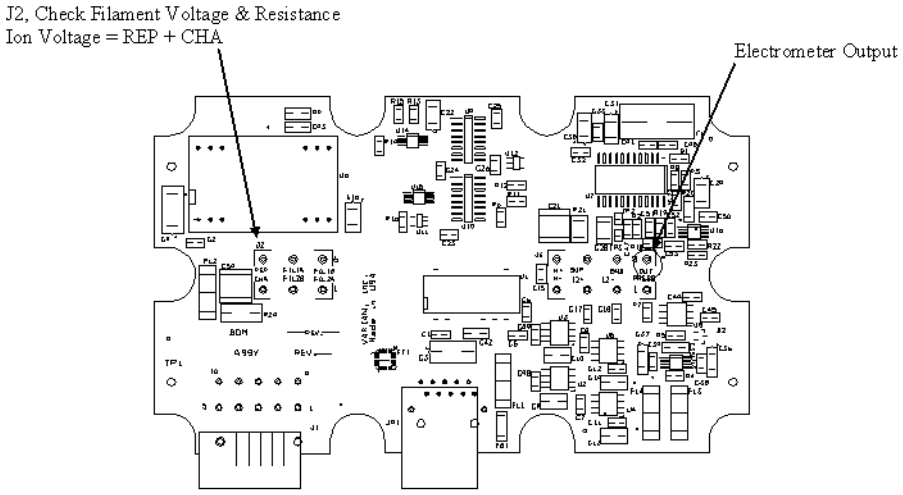

Figure D-12 Pre-Amp Board - Measurement Points

a. Measure on the pre-amp board the voltage present at the header pin labeled *PRESS* (spectrometer pressure output).

b. Carefully remove the ion source power cable (warning high voltage present), if the measured voltage is greater than 1.5 VDC.

c. Re-measure the voltage at the *PRESS* pin. The voltage should be 0. If a constant steady state voltage is measured, replace the pre-amp board.

CAUTION

Many components of the leak detector are static sensitive. Wear a grounding device when performing any maintenance on the leak detector, especially when performing maintenance of static sensitive parts, such as circuit boards and the spectrometer.

Table D-1 gives the spectrometer header, pre-amp board J1 connector pin assignments.

Table D-1 Spectrometer Header, Pre-amp Board J1 Pin Assignments

Chamber	Repeller	Filament #2		Filament #2
Filament #1	Filament #1			

Both Filaments Burnt Out error message appears on the front panel display

Both Filaments No Emission error message appears on the front panel display*

*Occurs for PD03 and PR02 (manufactured after Spring 2009).

This error can also occur during normal operation.

Causes/Resolutions

1. Both filaments are an open circuit due to age and prolonged normal everyday use:

   ❑ Spectrometer - Pre Amp Board (Figure D-11 and Figure D-12 on page D-11): Measure the J2 connector filament resistance (with power off) (filament resistance < .5 Ohm). If filaments are open circuit, open the spectrometer and replace the filaments. See Section 10 “Filament Replacement”.

2. Ion Source board failure:

   a. Ensure that the ion source board cable is secure at both the spectrometer and ion source board.

   b. If both filaments failed prematurely and both were replaced:

      ❑ Run a calibration (Figure D-11 on page D-10 and Figure D-12 on page D-11) and after a successful pass, measure the voltage of the filament that is in use on the Pre-Amp board J2 connector (Spectrometer Header). The filament voltage should = 1.4 to 1.9 VDC with < 30 mV of noise (AC). If not, go to the *Manual Tuning* screen and adjust the *Emission Current* until the AC ripple is < 50 mV and the filament voltage is 1.4 to 1.9 VDC.·

      ❑ Select *Setup Menu > Manual Tuning* screen and note the *Emission Current*. Measure the emission current (actually VDC) on the Ion Source board at test points EMISS T.P and TP101 FIL GND. The measured voltage should correspond to the observed reading in the *Manual Tuning* screen (within +/- 10%). If the emission current <.3 mA, the system senses no emission current, indicating that the filament is defective. Replace the filament.

Ion Source Bd. Assy. Rev G May 2007 the measured emission current will be a factor of 10 lower than observed emission. For example, Manual Tuning screen - Emission Current = .702, if measured on the Ion Source board = .0702.

   c. Adjust the emission in ether direction; the measured value should track the displayed value. If the measured emission current (voltage) is fixed at 1.5 to 3.0 VDC, replace the Ion Source board due to a failed emission regulation circuit:

      ❑ Remove the spectrometer header and inspect filaments for distortion and loss of thoria coating due to over heating; replace if needed

   d. *Select Setup Menu > Manual Tuning* screen and verify that the *Emission* or *Ion* is 0. Measure (with power on) the ion voltage (with respect to ground) on the pre-amp

board, J2 connection, pins labeled REP or CHA. The voltage range is from 198 to 287 VDC. If no high voltage is present replace the Ion source board.

e. If the high voltage is present and there is continuity for both filaments, verify if the filament voltage is present at either of the two filaments (Filament Voltage 1.3 to 1.8 VDC). If there is no filament voltage or < 1.0 VDC is measured replace, the ion source board.

3. Contaminated spectrometer - Emission current cannot be established - ion source:

   a. Refer to step 2b for steps to measure filament resistance, ion voltage and filament voltage. Verify (Figure D-12 on page D-11 and Figure D-10 on page D-10):

      ❑ Continuity for both filaments.·

      ❑ Reverify that the ion and filament voltage are available at the spectrometer. If yes, continue to the step b.

   b. Select *Setup Menu > Manual Tuning* and note the *Emission Current* setting. Measure the emission current on the Ion Source board (Figure D-13 on page D-16) at test points EMISS T.P and TP101 FIL GND. The measured voltage should correspond to the noted reading (within +/- 10%). If emission current < .3 mA or zero, inspect the spectrometer for contamination (if necessary, replace the ion source). See Figure D-10 on page D-10 and Figure D-11 on page D-10.

D.2 Operational Failures

NOTE

*A flashing C indicates that the leak detector has failed a calibration attempt or that the calibration routine was interrupted. For example, by pressing **Vent** during the calibration routine and going back into Test.*

Gain Too High error message and a flashing *C* appear on the front panel display after a calibration attempt.

Insufficient helium signal during calibration - Gain > 6.9

Causes/Resolutions

1. Calibrating to the wrong calibrated leak or the leak rate value was incorrectly entered:

   a. Open the *Calibration Set Up* screen and verify that the correct calibrated leak is selected.

   b. Select *Setup Menu > Maintenance Option > Internal Calibrated Leak* and verify that the programmed parameters match the calibration certificate or physically check the information on the label for the internal standard leak (Figure D-5 on page D-6).

2. Internal or external calibrated leak is damaged/destroyed. If the:

   ❑ Internal full calibration failed; try calibrating to an external calibrated leak.

- ❑ External calibration is successful turn on the internal calibrated to validate the leak rate and vice versa.

3. Calibrated leak valve or valve driver board is defective:
   - ❑ Verify that the valve error symbol is present. If:
     - ❑ Yes -Measure the resistance of V6 (resistance ~ 115 Ohms). It shorted or open, replace V6 (Figure D-5 on page D-6).
     - ❑ No - Open the *Manual Valve* screen and toggle the standard leak valve and listen for activation. If activation is not heard, check the connection between V6 and its valve.
4. Filament failure - not generating enough electrons for proper ionization to occur:
   - ❑ Switch filaments and re-calibrate and if the second filament fails, inspect the ion source and filaments and replace (Figure D-11 on page D-10). See Section 10 “Filament Replacement”.
   - ❑ Measure the voltage with respect to filament (1 and 2). The voltage should be 88 VDC ±1%; if not replace ion source board.
5. Contaminated ion source:
   - ❑ Inspect ion source and if contaminated (discoloration), clean ion source or replace (Figure D-10 on page D-10).
6. Electrometer failure (spectrometer):
   a. Select *Setup Menu > Manual Tuning*. Note, the offset reading (mV); if the offset reading is -1000000/-1000000, perform the following:
   - ❑ On the J3 connector of the pre-amp board (Figure D-12 on page D-11), measure the voltage (with respect to ground) on the pin labeled OUT. The voltage should be in mV DC with no leak present.
     If the voltage reads:
     - ❑ -11.00 VDC, remove the ion source voltage cable (J1 connector) on the pre amp board (Figure D-12 on page D-11) and re-measure the OUT pin voltage.
     - ❑ -11.00 VDC, with no high voltage or filament voltage, the electrometer is defective. Replace the spectrometer header or entire spectrometer.

Extended Sensitivity (Gain) with Range Stop/Manual Range

The VS Series leak detector has an MDL sensitivity of 5E-12 std cc/sec He when the unit ships from the factory. In order to maintain this sensitivity requirement the gain calibration cannot be greater than 6.9.

- ❑ This sensitivity specification might be too stringent for end users that, for example, only require an E-7 to E-8 std cc/sec He reject set point.

Activating the range stop extends the sensitivity requirements for calibration, thus eliminating unnecessary calibration errors (see Table D-2).

Table D-2 Range Stop/Sensitivity Requirements

Range Stop	Max Gain	MDL
OFF	6.9	5.00E-12
ON at		
-11	6.9	5.00E-12
-10	10	5.00E-11
-9	20	5.00E-10
-8	50	5.00E-09

There are guidelines for activating or setting the Range Stop or Manual Range after a *Gain Too High* error condition occurs:

- When a calibration is complete and the gain has been calculated and the correct Range Stop has been applied, the Range Stop value cannot be lowered (example: changing E-8 to E-9). The out of range symbol (<>) appears, thus not allowing the change.
- Once the Range Stop has been activated it cannot be deactivated. The lock symbol appears on the front display:
  - De-activating the Range Stop can be achieved if spectrometer maintenance has been performed; for example, changing the filaments or ion source. Perform a full internal calibration. Once the calculated gain <=6.9 after a full calibration procedure the Range Stop can be turned off.
- Manual Range - *Gain Too High*
  - De-activate Manual Range
  - Select the desired Range Stop and activate if it less than the previous Manual Range value (See Table D-2)
  - Re-calibrate
    - Calibration successful - activate Manual Range

NOTE

The Manual Range value cannot be lower than the Range Stop value allowed by the max gain. The out of range symbol (<>) appears, thus not allowing the change.

Gain Too Low error message and a flashing *C* appear on the front panel display after a calibration attempt

Too much helium signal during calibration - Gain <.8.

Causes/Resolutions

1. Calibrating to the wrong calibrated leak or the leak rate value was incorrectly entered:
   a. Open the *Calibration Set Up* screen and verify that the correct calibrated leak is selected.
   b. Select *Setup Menu > Maintenance Option > Internal Calibrated Leak* and verify that the programmed parameters match the calibration certificate or physically check the information on the label for the internal standard leak (Figure D-5 on page D-6).
2. Leak present in system:
   ❑ Leak check the system; concentrate around the internal calibrated leak, spectrometer, turbo pump, mechanical pump and foreline connection.
3. Emission current set to high:
   a. Select *Setup Menu > Manual Tuning*. Note the emission reading. The factory default is .702 mA, but adjustments can be made. If the Emission is set for >1.0 mA it may be necessary to turn it down.
   b. Measure test points EMISS T.P and TP101 FIL GND (*Emission* current) on the Ion Source board (Figure D-13). The measured voltage should correspond to the observed reading in the *Manual Tuning* screen (within +/- 10%). If the measurement voltage (*Emission* current) is > 2.0 VDC and cannot be adjusted, replace the Ion Source board.

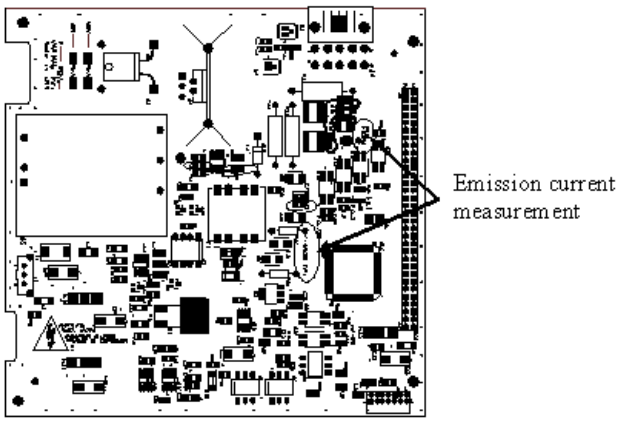

Figure D-13 Ion Source Board - Measurement Points

   c. Turn down the emission current to .702 and perform a full calibration and verify that it was successful.

4. Foreline Pump - elevated foreline (test port) pressure:
   - ❑ MR15 and PR02 models: Check the operating hours, which are found in the *Fore Pump* menu. Inspect oil and if necessary change.
   - ❑ MD30 models: Check the operating hours, which are found in the *Fore Pump* menu. Investigate the maintenance schedule in the scroll pump manual. > 7000 hours typically require cleaning and tip seal replacement.

Offset Fault error message and a flashing *C* appear on the front panel display after a calibration attempt

Causes/Resolutions

1. Defective electrometer (spectrometer assembly):
   a. Go to the *Manual Tuning* screen and observe the first offset value (uV).
   b. Power off and remove front and back covers.
   c. Remove the aluminum cover of the spectrometer and reconnect the ion source and pre-amp cables and verify that the pre-amp going to the Mother board is secure.
   d. Power unit back up.
   e. Place the leak detector in Hold or Vent.
   f. On the Pre-Amp board, measure the voltage with a DMM the pin labeled *OUT* (electrometer output) with reference to ground.

   The voltage should be in the mV DC range. Verify if the voltage reading is in V and matches the large offset reading observed prior in the *Manual Tuning* screen.

   g. Carefully remove the Ion Source (high voltage) cable from the pre amp board and re-measure the electrometer output.

   If the large voltage reading (-500mV to -11 VDC) is still present in the absence of the ion source high voltage and the filament voltage the electrometer is defective: Replace the spectrometer header assembly or the entire spectrometer assembly.
2. Defective Pre-Amp board (A/D converter-corrupted):
   a. Place the leak detector in Hold or Vent.
   b. On the Pre-Amp board measure the voltage with a DMM the pin labeled *OUT* (electrometer output) with reference to ground:
      - ❑ Confirm that the electrometer output is approximately between -20 to +20mV DC.
      - ❑ Place the leak detector in Test and activate the internal standard leak.
      - ❑ Verify that the electrometer output is approximately between -20 to -100mV.
      - ❑ Attempt another full internal calibration. If the calibration aborts to an *Offset Fault* condition go into the *Manual Tuning* screen and observe the first *Offset* reading. The Offset reading should be between -20000 to +20000 uV for a normal operating Pre-Amp board.

c. Replace the Pre-Amp board or Spectrometer Header assembly if the observed *Offset* reading is abnormally higher (ex. -1000000 to -10000000 uV) than what was measured above.

High Background error message and a flashing *C* appear on the front panel display after a calibration attempt

Causes/Resolutions

1. Helium background is >1E-5 std cc/sec He in Test (ContraFlow) or E-7std cc/sec He in Fine Test (Midstage):

   a. This is sometimes due to leak checking parts that have gross leaks thus saturating the leak detector with helium:

   ❑ MR15 - Open the gas ballast on the DS302 for 5 minutes and then shut off the gas ballast and re-calibrate. Repeat the process, if necessary, until the leak detector completes a full internal calibration.

   ❑ MD30/PD03 - Place a light Nitrogen purge in the test port of the leak detector and throttle the Nitrogen until the leak detector transfers into Test or Fine Test for several minutes. Repeat the process, if necessary, until the leak detector completes a full internal calibration.

   ❑ PR02 - Remove the test port cap or plug and place the leak detector into Test and run for several minutes at atmospheric pressure. Repeat the process, if necessary, until the leak detector completes a full internal calibration.

   b. Possible leaks in the foreline connections or bellows:

   ❑ Inspect and fix - leak check foreline.

   c. Defective foreline pump (MD30, MR15 & PD02 models):

   ❑ Activate a High Pressure Test in the Leak Rate Ranging Menu with the test port blanked off and observe the test port pressure after twp minutes. A typical baseline pressure of 10 mTorr should be achieved; 100 mTorr or higher indicates a poor performing primary pump.

   d. MD30/PD03 models only - High ambient helium background due to poor helium management; excessive spraying of helium and poor ventilation:

   ❑ MD30 - Plumb in a nitrogen purge (15 sccm or 2 psi) at the inlet of the scroll pump. Verify that the test port pressure is <100mTorr while in Test.

   ❑ PD03 - Verify that the diaphragm pump is functional, electrically (running) and creating a vacuum.

No Ion Peak error message and a flashing *C* appear on the front panel display after a calibration attempt

Output from A/D converter on the pre-amp board is constant (no- change in reading).

Causes/Resolutions

1. Cable (w/RJ45 connectors) from Pre-Amp board to motherboard disconnected:
   - ❑ Check the cable and re-calibrate.
2. Pre-Amp board failure (Figure D-12 on page D-11):
   a. Measure the voltage, with respect to ground, on the pre-amp board J3 connector OUT pin.
   b. Monitor the output voltage during the calibration routine.
   c. Monitor the A/D output from the Pre-Amp board by connecting a laptop to the leak detector using HyperTerminal.
   d. Enter the command: *'AD_READ @ . CR 1 SECS MANY*
   The following response appears (example):
   8390438...8391004...8390710...8390937 (continues until *ESC* is entered).
   e. Perform a full calibration and note the electrometer output voltage. The voltage should be scaling up and down as the ion voltage is scanning. The same should be happening for the A/D output.
   f. If the:·
      - ❑ Response back from the A/D is not changing, the A/D on the Pre-Amp board is defective. Replace the Pre-Amp board.
      - ❑ Electrometer was not responding during the calibration, measure and verify that +/- 12 VDC is available on the Pre-Amp board J3 connection.
3. Electrometer failure (spectrometer):
   - ❑ If +/- 12 VDC is:·
     - ❑ Not measured, replace the Pre-Amp board.
     - ❑ Available on the Pre-Amp board, use the same troubleshooting method in step 2. Both the electrometer and the A/D will not respond, as the electrometer has failed. Install a new spectrometer header.

Leak Detector will not go into *Test*

Causes/Resolutions

1. Panel Lockout:
   - ❑ Select the *Control Panel Access* menu. Verify that *Panel Lockout* is enabled.
2. Test Port TC defective:
   - ❑ The leak detector will not go into *Test* if the test port TC is open circuit. Measure the resistance of the TC. (Figure D-5 on page D-6). Any combination of the 4 pins (resistance = 1.5 Ohms).
3. Pumping down against a gross leak - test port pressure > 10 Torr:
   a. Blank off the test port and verify that the leak detector goes into Test.
   b. Connect the item for leak checking and verify that all fixturing connections are tight.
4. Front Panel Display - Test button defective:
   a. Connect a laptop to the leak detector using HyperTerminal.
   b. Enter the command: *ROUGH* and verify if the leak detector goes into Test. If the command worked, replace the front panel display.
5. Valve Driver board failure:
   a. Communication failure between motherboard and valve driver board:
      - ❑ Press **Test** and if *ROUGHING* does not appear on the front display, verify the RS-232 communication cable from the motherboard to the Valve Driver board (Figure D-4 on page D-5)is secure. If it is secure, the *Test* button is defective.

   b. Defective valve driver channel:
      - ❑ Verify if a valve error symbol is present on the front panel display:
      - ❑ Open the *Manual Valve Control* screen and toggle the *Vent valve* or *Contra Flow* Valve.
      - ❑ Verify that the valves are heard turning off and on. If this does:
        - ❑ Not occur, replace the Valve Driver board.
        - ❑ Occur, proceed to the next step.
6. Foreline pump failure:
   a. Blank off test port and press **Test**.
   b. Verify the test port pressure. The pressure should go down to <1E-3. If no gross leak was found in step 3, replace the foreline pump.
7. I/O Board enabled:
   - ❑ Disable the Parallel Enable signal.

Leak Detector will not go into *Vent*

Causes/Resolutions

1. Vent Lockout button active:
   - ❑ Open the *Control Panel Access* screen and verify that *Vent Lockout* is active.
2. Panel Lockout button active:
   - ❑ Open the *Control Panel Access* screen and verify that *Panel Lockout* is active.
3. Vent button - front panel display button active:
   - ❑ Select *Setup Menu > Manual Valve Control* and toggle the vent valve. If leak detector vents, the *Vent* button is defective, replace the front panel.
4. Vent Valve is defective:
   a. Verify that the valve error symbol is present on the front panel display.
   b. Using an Ohmmeter, verify the vent coil resistance is between 9 and 10 Ohms. If the coil's resistance is open or shorted replace the valve.
5. Valve Driver board failure:
   a. Disconnect the V7 (Vent Valve) connector, disconnect V4 and V5 and place V5 connector on V7 (Vent Valve).
   b. Open the *Manual Valve Control* screen and toggle the *Midstage Valve* and verify if the vent valve toggles. If the vent valve toggles, replace the Valve Driver Board due to a bad valve channel (Figure D-4 on page D-5).

D.3 Performance Issues

High helium background - after a full calibration with the test port blanked off

Causes/Resolutions

1. Leak at the test port:
   a. Blank off the test port, press **Test** and let the background stabilize.
   b. Open the *Manual Valve Control* screen and turn off the *Midstage* valve. Verify that the leak rate lowers.
   c. Clean and leak check the test port.
2. Vent Valve leak:
   a. Perform a full calibration and let the background stabilize.
   b. Zero out the background and leak check the vent valve (Figure D-5 on page D-6).
3. Filament condition:
   ❑ Switch filaments and perform a full calibration.
4. Contaminated ion source/spectrometer: Both filaments 1 and 2 produce a high helium background:
   a. Open the spectrometer and inspect the ion source for contamination (carbon buildup) or noticeable discoloration (Figure D-10 on page D-10).
   b. Clean or replace the ion source and filaments (Figure D-11 on page D-10).
5. Electrometer offset /noise drift:
   a. Measure the voltage, with respect to ground, on the pre-amp board (Figure D-12 on page D-11), J3 connector OUT pin.
   b. Monitor the output voltage (low mV range).
   c. Unplug the P1 (ion source bd. cable) cable and observe if the leak rate is 0.0E-11 and electrometer output voltage <= 5mV DC. If the leak rate and output voltage remain unchanged or very unstable replace spectrometer header or entire spectrometer.
6. Foreline pump (MD30) failure:
   ❑ Replace the tipseal.

Unstable leak rate reading - (Test and Fine Test modes of operation)

Causes/Resolutions

1. Leak in system:
   ❑ Perform a full calibration, blank off test port and leak check the system.
2. Filament - unstable/damaged:
   ❑ Switch filaments and verify if instability has been eliminated.

3. Contaminated ion source: If both filaments 1 and 2 produce an unstable background reading (Figure D-11 on page D-10):
   a. Open the spectrometer and inspect ion source for contamination (carbon buildup) or noticeable discoloration (Figure D-10 on page D-10 and Figure D-11 on page D-10).
   b. Clean or replace ion source and filaments.
4. Electrometer - cooler failure (Figure D-11 and Figure D-12 on page D-11):
   a. Verify that 5.0 VDC is present on the pins labeled H+ and H on the Pre-amp board.
   b. Power off the unit and measure resistance of pins H(+) and H(-); resistance should be between 15 to 45 Ohms.
   c. Replace the spectrometer header (Figure D-8 on page D-9) or entire spectrometer if the voltage or resistance is not within specification (Figure D-4 on page D-5).
5. Foreline pump failure:
   a. Lock system into *High Pressure Test* and perform a full calibration.
   b. Let the system stabilize and verify instability. If the foreline pump is a:
      - ❑ Rotary vein mechanical pump, drain and add new oil.
      - ❑ Dry scroll pump, replace tip seal or pump module.

   If needed replace foreline pump.
6. Ion Source board Emission Current noise regulation > 100 mVAC:
   a. Open the *Manual Tuning* menu and adjust and measure the emission current (Figure D-13 on page D-16), to minimize the emission current to < 30 mVAC.
   b. If after adjustment, emission current noise is > 100 mV AC:
      - ❑ Switch filaments: if no change,
      - ❑ replace ion source board, if no change (noise > 100 mVAC),
      - ❑ replace the ion source (Figure D-10 on page D-10).

Leak detector will not transfer into *Fine Test* (Midstage) model

Causes/Resolutions

1. Background greater than 1.5E-7 std cc/sec He (leak/contamination):

   ❑ Perform steps in order until background normailzes:

   a. Leak in system - leak check.
   Open the *Manual Tuning* screen and verify high negative offset values.

   b. Switch filaments and calibrate.

   c. Contaminated ion source - clean spectrometer and replace ion source (Figure D-10 on page D-10 and Figure D-11 on page D-10).

2. Test port pressure > 100 mTorr - defective foreline pump:

   ❑ Perform steps in order until pressure normailzes:

   a. Replace foreline pump.

   b. Rotary vein mechanical pump - drain and replace oil.

   c. Dry scroll pump - replace tip seal or pump module.

3. Test Port TC:

   ❑ Not calibrated correctly

   a. Open the *Gauge Calibration* screen and ensure that the spectrometer pressure < 1E-5 Torr and that the leak detector is in *Test*.

   b. Open the *Manual Valve Control* screen, turn off the Contraflow and turn on the Midstage valve.

   c. Open the *Gauge Calibration* screen and let the system stabilize for a few minutes.

   d. Press the **Test Port Vacuum** button and ensure *CAL OK* appears and the *Test Port Pressure* is reading < 1.0E-3 Torr.

   e. Press **Vent**, open the *Gauge Calibration* screen, press *Test Port ATM* and ensure *CAL OK* appears and that the *Test Port Pressure* is reading 7.6E+02 Torr.

   f. Open the *Home* screen (test port blanked), press **Test** and verify that the leak detector transfers into Fine Test.

   ❑ Contaminated -In stressful environments (Figure D-5 on page D-6):

   ❑ Remove the TC and fill and soak for several minutes with Acetone.

   ❑ Fill and rinse two to three times with isopropyl alcohol.

   ❑ Install the TC and verify if the system goes into Fine Test. Then calibrate the TC at atmosphere and vacuum.

   If necessary replace TC.

4. Diaphragm Pump (PD03):
   - ❑ Disconnect hose to diaphragm pump inlet and verify system and pump motor are making audible sounds.
   - ❑ Check diaphragm pump for damaged diaphragm and replace if required.
   - ❑ Replace diaphragm pump (especially pump HR5 > 15000 hours)
5. V8 (PD03 only) – Exhaust valve not activating:
   - ❑ Verify on the front panel display that the valve error symbol is flashing – replace V8,
   - ❑ Verify in the Manual Valve menu that V8 indicates a failure (red circle) – replace V8.
   - ❑ Valve Driver Board failure – (remove covers) while in Test, disconnect power connections for V8 and measure if 24 VDC is present; if not replace the Valve Driver board.

Front Panel Display - Difficulty selecting menus or in activating/deactivating features/ options

Causes/Resolutions Front Panel Display is out of calibration:

- ❑ Re-calibrate front panel by:

a. Turning off leak detector.

b. Place and hold a finger on front panel and hold; power up unit.

c. A blue screen appears with the message *Touch all Crosshairs*. In every corner of the screen a crosshair appears; touch all four crosshairs.

d. A second message appears *Accept Calibration*; select *Accept*.

Appendix E. Interconnection Diagram

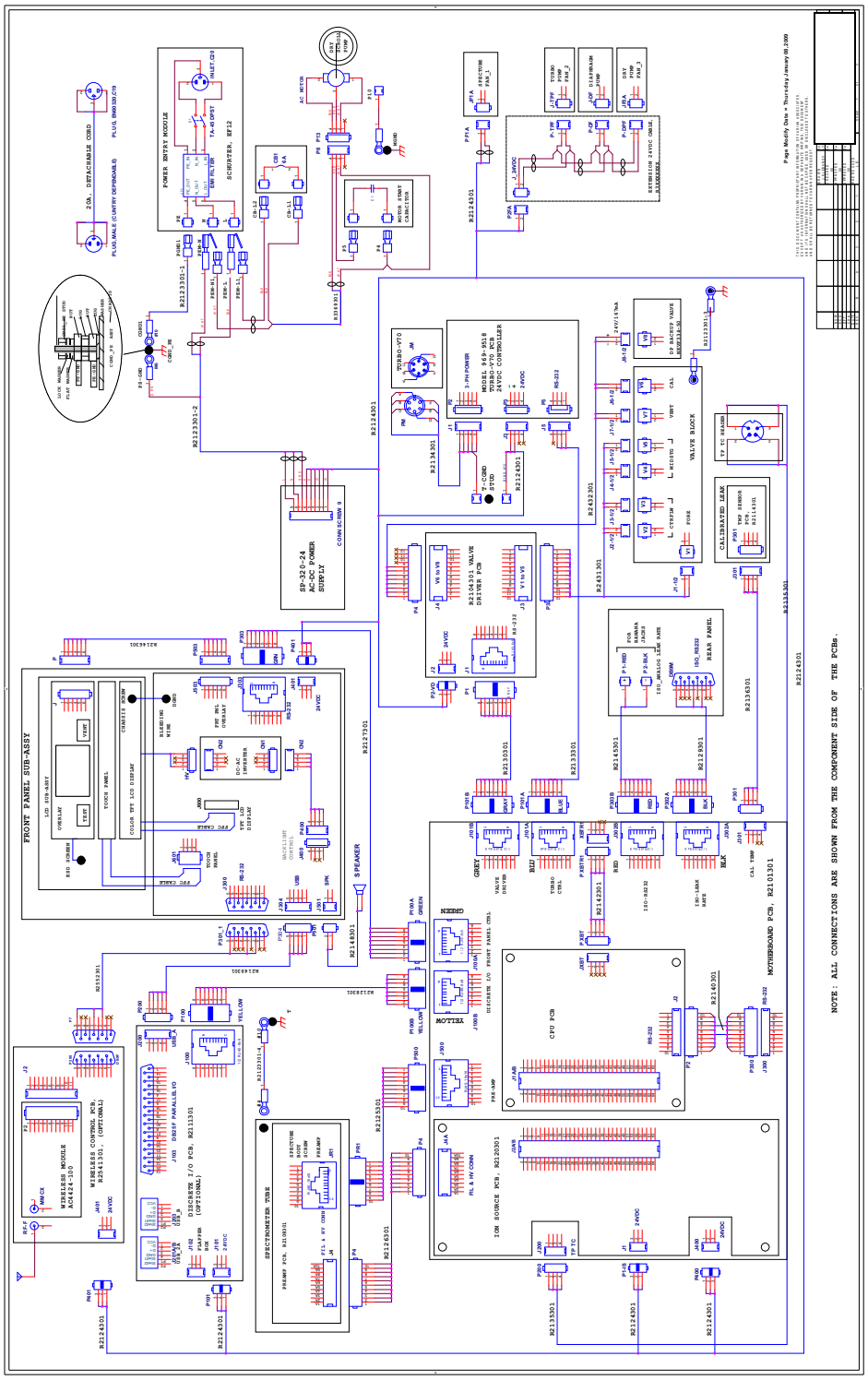

Figure E-1 Interconnection Diagram

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Agilent Technologies

Vacuum Products Division
Instructions for returning products

Dear Customer:

Please follow these instructions whenever one of our products needs to be returned.

1) Complete the attached Request for Return form and send it to Agilent Technologies (see below), taking particular care to identify all products that have pumped or been exposed to any toxic or hazardous materials.

2) After evaluating the information, Agilent Technologies will provide you with a Return Authorization (RA) number via email or fax, as requested.
Note: Depending on the type of return, a Purchase Order may be required at the time the Request for Return is submitted. We will quote any necessary services (evaluation, repair, special cleaning, eg).

3) **Important steps for the shipment of returning product:**
   - Remove all accessories from the core product (e.g. inlet screens, vent valves).
   - Prior to shipment, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
   - If ordering an Advance Exchange product, **please use the packaging from the Advance Exchange to return the defective product.**
   - Seal the product in a plastic bag, and package product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
   - Agilent Technologies is not responsible for returning customer provided packaging or containers.
   - **Clearly label package with RA number**. Using the shipping label provided will ensure the proper address and RA number are on the package. Packages shipped to Agilent without a RA clearly written on the outside cannot be accepted and will be returned.

4) Return only products for which the RA was issued.

5) **Product being returned under a RA must be received within 15 business days.**

6) **Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information.** Customer is responsible for freight charges on returning product.

7) Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.

RETURN THE COMPLETED **REQUEST FOR RETURN** FORM TO YOUR NEAREST LOCATION:

EUROPE:	**NORTH AMERICA:**	**PACIFIC RIM:**
Fax: 00 39 011 9979 330		
Fax Free: 00 800 345 345 00	Fax: 1 781 860 9252	please visit our website for individual
Toll Free: 00 800 234 234 00	Toll Free: 800 882 7426, Option 3	office information
vpt-customercare@agilent.com	vpl-ra@agilent.com	http://www.agilent.com

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please read important policy information on Page 3 that applies to all returns.

1) CUSTOMER INFORMATION

Company Name:	**Contact Name:**
Tel: **Email:**	**Fax:**
Customer Ship To:	**Customer Bill To:**
Europe only: **VAT reg. Number:**	USA/Canada only: ☐ **Taxable** ☐ **Non-taxable**

2) PRODUCT IDENTIFICATION

Product Description	Agilent P/N	Agilent S/N	Original Purchasing Reference

3) TYPE OF RETURN (**Choose one from each row** and supply Purchase Order if requesting a billable service)

3A. ☐ Non-Billable ☐ Billable ➡ New PO # (hard copy must be submitted with this form):

3B. ☐ Exchange ☐ Repair ☐ Upgrade ☐ Consignment/Demo ☐ Calibration ☐ Evaluation ☐ Return for Credit

4) HEALTH and SAFETY CERTIFICATION

AGILENT TECHNOLOGIES CANNOT ACCEPT ANY PRODUCTS CONTAMINATED WITH BIOLOGICAL OR EXPLOSIVE HAZARDS, RADIOACTIVE MATERIAL, OR MERCURY AT ITS FACILITY.
Call Agilent Technologies to discuss alternatives if this requirement presents a problem.

The equipment listed above (check one):

☐ **HAS NOT** pumped or been exposed to any toxic or hazardous materials. OR
☐ **HAS** pumped or been exposed to the following toxic or hazardous materials. If this box is checked, the following information must also be filled out. Check boxes for all materials to which product(s) pumped or was exposed:

☐ Toxic ☐ Corrosive ☐ Reactive ☐ Flammable ☐ Explosive ☐ Biological ☐ Radioactive

List all toxic/hazardous materials. Include product name, chemical name, and chemical symbol or formula:

_____

NOTE: If a product is received at Agilent which is contaminated with a toxic or hazardous material that was not disclosed, **the customer will be held responsible** for all costs incurred to ensure the safe handling of the product, and **is liable** for any harm or injury to Agilent employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.

Print Name: **Authorized Signature: .....** **Date:**

5) FAILURE INFORMATION:

Failure Mode (REQUIRED FIELD. See next page for suggestions of failure terms):
Detailed Description of Malfunction: (Please provide the error message)
Application (system and model):

I understand and agree to the terms of Section 6, Page 3/3.
Print Name: **Authorized Signature: .....** **Date:**

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please use these Failure Mode to describe the concern about the product on Page 2.

TURBO PUMPS and TURBO CONTROLLERS

APPARENT DEFECT/MALFUNCTION		POSITION	PARAMETERS	
- Does not start	- Noise	- Vertical	Power:	Rotational Speed:
- Does not spin freely	- Vibrations	-Horizontal	Current:	Inlet Pressure:
- Does not reach full speed	-Leak	-Upside-down	Temp 1:	Foreline Pressure:
- Mechanical Contact	-Overtemperature	-Other:	Temp 2:	Purge flow:
- Cooling defective	-Clogging	.....	OPERATING TIME:	

ION PUMPS/CONTROLLERS

- Bad feedthrough	- Poor vacuum
- Vacuum leak	- High voltage problem
- Error code on display	- Other

VALVES/COMPONENTS

- Main seal leak	- Bellows leak
- Solenoid failure	- Damaged flange
- Damaged sealing area	-Other

LEAK DETECTORS

- Cannot calibrate	-No zero/high backround
- Vacuum system unstable	- Cannot reach test mode
- Failed to start	- Other

INSTRUMENTS

- Gauge tube not working	- Display problem
- Communication failure	- Degas not working
- Error code on display	- Other

SCROLL AND ROTARY VANE PUMPS

- Pump doesn't start	- Noisy pump (describe)
- Doesn't reach vacuum	- Over temperature
- Pump seized	- Other

DIFFUSION PUMPS

- Heater failure	- Electrical problem
- Doesn't reach vacuum	- Cooling coil damage
- Vacuum leak	- Other

Section 6) *ADDITIONAL TERMS*

Please read the terms and conditions below as they apply to all returns and are in addition to the Agilent Technologies Vacuum Product Division – Products and Services Terms of Sale.

- Customer is responsible for the freight charges for the returning product. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.
- Customers receiving an Advance Exchange product agree to return the defective, rebuildable part to Agilent Technologies **within 15 business days**. Failure to do so, or returning a non-rebuildable part (crashed), will result in an invoice for the non-returned/non-rebuildable part.
- Returns for credit toward the purchase of new or refurbished Products are subject to prior Agilent approval and may incur a restocking fee. Please reference the original purchase order number.
- Units returned for evaluation will be evaluated, and a quote for repair will be issued. If you choose to have the unit repaired, the cost of the evaluation will be deducted from the final repair pricing. A Purchase Order for the final repair price should be issued within 3 weeks of quotation date. Units without a Purchase Order for repair will be returned to the customer, and the evaluation fee will be invoiced.
- A Special Cleaning fee will apply to all exposed products per Section 4 of this document.
- If requesting a calibration service, units must be functionally capable of being calibrated.

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QUALITY SYSTEM ISO 9001 CERTIFIED

ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001 REGISTERED

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CE